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Organization of American Scientists for the War. II: DR. KARL T. COMPTON 93

The Biochemistry of Anthocyanins: WILDER D. BANCROFT 98

Obituary:
Joseph Sweetman Ames: DR. LYMAN J. BRIGGS. *Recent Deaths* 100

Scientific Events:
Message from Chinese Men of Science; The Aquarium of the Zoological Park, London; The Resources of Virginia; Rare Chemicals; Gifts and Grants to the University of Wisconsin; The New Preference and Limitation Order on Laboratories and Laboratory Equipment; The Mathematical Association of America; The President of the Society of Chemical Industry 102

Scientific Notes and News 105

Discussion:
Census Areas for the United States, 1940: DR. CLARENCE E. BATSCHELET and MALCOLM J. PROUDFOOT. *Riboflavin-Vitamin B_2 in Soil:* PROFESSOR C. C. CARPENTER. *Apparent Time Acceleration with Age of the Individual:* F. W. NITARDY 107

Scientific Books:
Stratigraphy: Dr. H. E. VOKES. *Minerals and Rocks:* PROFESSOR C. S. HURLBUT, JR. *Qualitative Analysis:* DR. WENDELL H. TAYLOR. *Diseases of Domestic Animals:* DR. HERBERT L. RATCLIFFE 110

Special Articles:
Observations Concerning the Etiology of Primary Atypical Pneumonia: DR. HARRY M. ROSE AND ELEANORA MOLLOY. *Loss of Proprioceptive Reflexes Following Retrograde Degeneration:* DR. BERRY CAMPBELL 112

Scientific Apparatus and Laboratory Methods:
An Improved Instrument for Measuring Capillary Fragility: PROFESSOR R. A. WAUD and DR. H. G. SKINNER. *A Simplified All-Purpose Gravity Writing Lever:* DR. H. R. HULPIEU. *A Simple Timing Device for Speakers:* DR. NEAL A. WEBER 115

Science News 8

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ORGANIZATION OF AMERICAN SCIENTISTS FOR THE WAR.[1] II

By Dr. KARL T. COMPTON

PRESIDENT, MASSACHUSETTS INSTITUTE OF TECHNOLOGY

WAR-TIME SCIENTIFIC ORGANIZATION

In spite of the apparently complete peace-time organization which I have just described, it has always been our experience, in the time of great emergency, that it appears advisable to establish temporary new agencies to deal particularly with the emergency. For example, I happened to be attached to one of these temporary agencies during the last war and I mention the matter not only by way of illustration but also because it will enable me to relate an anecdote about your late distinguished colleague, then Sir Ernest Rutherford.

This agency was the Research Information Service, set up jointly by our Military Intelligence, Naval Intelligence and Council of National Defense, with offices in Washington, London, Paris and Rome. The function of these offices was essentially the same as that of the scientific liaison offices which have been operating so effectively between units of the British Commonwealth and the United States during the present war.

The head of the Research Information Service in London was the late Professor Bumstead, whom some of you doubtless remember. I was attached to the Paris office and happened to be temporarily in charge during the time when an allied conference on submarine detection was arranged in Paris under the auspices of this office.

One of the delegates from Great Britain was Sir Ernest Rutherford, who had been collaborating closely with the French physicist, Paul Langevin, in the development of underwater supersonic devices. The day

[1] Pilgrim Trust Lecture, under the auspices of the Royal Society of London, May 20, 1943.

before the conference, when the British and American delegations came over from London, Rutherford was not present, but he sent me a letter, delivered by Professor Bumstead, stating that some very recent experiments which he and his research assistant had been carrying on in the Cavendish Laboratory had apparently indicated success in disintegrating the nucleus of the hydrogen atom. "If this is true," Rutherford wrote, "it is a fact of far greater importance than the war." He went on to say that he was in the midst of a second experiment to check these startling findings and that he would be delayed a couple of days pending the termination of this experiment. Then Rutherford added as a postscript: "Tell nobody about this because I may be mistaken." Later it developed that what Rutherford had actually done had not been to disintegrate the hydrogen nucleus, but rather to disintegrate the nuclei of nitrogen atoms. So far as I know, Rutherford's letter to me was the first written indication of success in the long, long struggle to produce by artificial means a transmutation of one chemical element into another. I wish I had kept that letter and had turned it over to Professor Eve at the time when he was writing his interesting biography of Ernest Rutherford. But to return to our topic:

I have frequently tried to analyze the reasons for the establishment of special scientific agencies during times of crisis. The reasons I think are varied and rather fundamental. One of them is that every great crisis involves conditions so different from the normal situation that the types of organizations which can survive and operate during peace-time are not adequate to meet the emergency. It may be, for example, that the emergency calls for exercise of very extensive administrative functions, such as the supervision of research projects and the disbursement of large governmental funds to a far greater extent than in peace-time. Hence a peace-time body of scientists organized primarily to exercise advisory functions may not be organized in a manner suited to prompt and efficient executive action. Another reason is the impossibility of always maintaining in the administrative positions of peace-time agencies the personnel who would be most effective for handling important projects in a war emergency. Men who have the proper capabilities are frequently too busy and too active in other directions to be willing to hold down positions in a peace-time organization which is relatively inactive. Consequently, when the emergency comes, the only alternatives may be to change the leadership in the existing organizations, a difficult if not impossible process, or to set up new temporary agencies to deal with the emergency.

Whatever the reasons may be, this present war emergency has run true to form and has resulted in the establishment of a group of special agencies of temporary character which I shall proceed now to describe. It is these agencies which are carrying the principal burden of the scientific research and development work related to the war, in the United States.

The National Roster of Scientific and Specialized Personnel was established early in July, 1940, when President Roosevelt approved a project for making available in one central office an index of all American citizens who have special scientific or professional skill. Headed by President Leonard Carmichael, of Tufts College, this agency operates under the War Manpower Commission under the Office for Emergency Management of the executive office of the President.

As a result of information secured from questionnaires mailed to all members of all scientific and professional organizations in the country, and supplemented by other information, an elaborate punch-card system has been set up in which practically every person in the country with specialized training or skill is listed with reference to his or her major professional fields and with the addition of a great deal of supplementary information regarding special interests, languages read or spoken, foreign countries traveled in, previous experience in the armed services or in industry, etc.

There are altogether 59 special fields listed in the Roster, falling under the general categories of administration and management, agricultural and biological sciences, engineering and related fields, humanities, medical sciences and related fields, physical sciences and social sciences. At the present time the total number of persons in this Roster is about 600,000, including, as of last October, 71,511 chemists, 7,297 mathematicians, 10,080 physicists or astronomers, 4,559 radio engineers, 14,729 electrical engineers, only 408 professional philosophers, and the smallest entry in the list is 142 speleologists.

As an illustration of the manner of use of this Roster I quote the following paragraph from a report by Dr. Carmichael: "How would you like to get an order for the names of all Americans who possess a knowledge of epidemiology and chemotherapy, who are competent in the diagnosis and control of *Endamoeba histolytica,* and other protozoan infections, have a knowledge of the Hindustani language, are skilled in the operation and use of specialized bacteriological research apparatus and who have traveled in the tropics?" To secure this information the stops of the punch-card sorting mechanism are pushed in at the appropriate places, the cards are ground

through the machine, and all those which conform to the above specifications fall out together.

The Roster was originally conceived to serve governmental agencies who might request information on scientific personnel. More recently, as serious manpower shortages have developed both in industry and in education, and as the armed services have become more and more concerned over the most effective use of all scientifically trained personnel, the Roster has been used to an increasing degree in connection with placement work and to give the supply and shortage data on professional groups. Up to the middle of last month the National Roster had certified more than 140,000 names of specialists to various agencies engaged in the war program in the United States.

Office of Scientific Research and Development (OSRD). Most important of the scientific agencies established specially to deal with problems of this war is the Office of Scientific Research and Development, whose director is Dr. Vannevar Bush, president of the Carnegie Institution of Washington. It was created by executive order of the President in June, 1941, and under it operate the National Defense Research Committee, which had been established just a year earlier, and also the more recently established Committee on Medical Research. The OSRD is directed to coordinate, and where necessary supplement, the scientific research and development work relating to the war among civilian agencies as well as those of the government, including the Armed Services. To facilitate this coordination the advisory council to the director of OSRD includes high-ranking representatives from the War and Navy Departments, the chairman of the National Advisory Committee for Aeronautics, the National Defense Research Committee and the Committee on Medical Research and, by invitation, the president of the National Academy of Sciences and the director of the newly established Office of Production Research and Development of the War Production Board.

The principal research and development activities of the OSRD are carried on under contracts with appropriate research institutions, these contracts being financed out of an annual Congressional appropriation. At the present time these contracts involve expenditures at the rate of about $100,000,000 per year, and there are currently active about 1,400 contracts with about 200 industrial laboratories and 100 educational or special research institutions. About 6,000 scientists and engineers of professional grade are engaged on these contracts, with the assistance of a considerably larger number of technicians of various types.

To facilitate interchange of information between OSRD and our British colleagues, an OSRD Liaison Office was established with offices in Washington and London, now headed by Dr. Caryl P. Haskins and Bennett Archambault, respectively. These, in cooperation with the similar liaison services of Great Britain, Canada and, less extensively, Australia and South Africa, have served well to knit together our joint scientific efforts.

The National Defense Research Committee (NDRC) operates to recommend to the director of OSRD research and development contracts in the field of instrumentalities, devices and mechanisms of warfare. Under the chairmanship of President James B. Conant, of Harvard University, this committee is composed of four civilian scientists, plus one representative each from the Army and Navy, and the Commissioner of Patents. Feeding into it come the recommendations from 19 divisions, most of which are subdivided into several sections. These divisions and sections are each built around a specific functional concept, such as fire control or sub-surface warfare or explosives. However, there are two divisions which are in the nature of "catch-alls." For example, the Division of Physics and the Division of Chemistry can be defined as handling everything in these respective fields which does not fall under any one of the more sharply defined divisions.

In addition to the 19 divisions of NDRC there are two panels concerned respectively with applied mathematics and engineering. The difference between a division and a panel is suggested by the fact that the Fire Control Division, for example, is concerned with the development of fire control instruments, whereas the Applied Mathematics Panel is not concerned with the development of applied mathematics as such, but rather with the use of mathematics to aid in accomplishing the objectives of the various divisions. For this reason the applied mathematics panel includes membership on each divisional committee in which applied mathematics is likely to be important. The Engineering Panel serves all the divisions to expedite the transition from the stage of research and development to the stage of quantity production under Army or Navy contract.

Intimate contact between NDRC and its divisions on the one hand, and the Armed Services on the other, is maintained at several levels by an extensive organization of Army and Navy liaison officers who have proved invaluable as channels for acquainting NDRC with the needs and desires of the Armed Services for new equipment and for making arrangements for demonstrations and service tests.

Proposals for research or development projects come to NDRC from a wide variety of sources—requests or suggestions from the Army or Navy, pro-

posals from industrial or academic research laboratories, promising inventions transmitted to NDRC from the National Inventors' Council, or in many cases projects originating within the NDRC committees themselves. However, the NDRC has complete freedom in making its decisions on the projects which it recommends to the director of OSRD and the priority attached to these projects, and the director of the OSRD has complete freedom in his own judgment to authorize the recommended contracts.

For reasons of security no person serves as a member of any NDRC committee unless he has been "cleared" by the Army and Navy Intelligence Offices, after investigation. Similarly, all personnel of the contractors working on the research and development projects are "cleared" by these intelligence offices to whatever degree is deemed advisable in virtue of the degree of secrecy attached to the project.

The Committee on Medical Research (*CMR*), under the chairmanship of Dr. A. Newton Richards, of the Medical School of the University of Pennsylvania, is in every respect parallel to the National Defense Research Committee in its organization and methods of operation. It deals exclusively with problems of war medicine such as shock, immunization or protection against types of diseases characteristic of the present theaters of war, etc. Though considerably younger and smaller than NDRC in both personnel and budget, it already has a record of substantial accomplishment.

Joint Committee on New Weapons and Equipment (*JNW*). The organizations described thus far have proven effective in organizing and administering research projects and in maintaining close relationships and exchange of information with the Armed Services and our British allies. In respect to the Armed Services, however, these relationships are primarily at the research and development level and for a time lacked one very important element necessary to make the work fully effective in the war. This missing element was an intimate relationship between the research and development agencies and the Highest Command of the Army and Navy who have the responsibility of planning the military or naval operations in which newly developed weapons might be used effectively or for which new devices should be developed. In order to fill this gap the U. S. Joint Chiefs of Staff in May, 1942, established the Joint Committee on New Weapons and Equipment, composed of Dr. Bush, director of OSRD, as chairman, the Assistant Chief of Staff G4 of the Army (now Brigadier General Moses) and the Chief of the Readiness Division of the Navy (now Rear Admiral De Laney).

JNW is charged by the chiefs of staff with correlating the research programs of Army, Navy and civilian agencies. It acts through subordinate bodies of which the special mission in which I am presently engaged in England is an example.

Through JNW any new weapon whose potentialities appear to be unusually significant is brought directly to the attention of the High Command for their consideration in the planning of future operations. Conversely, JNW offers a direct channel through which the High Command can pass down to the research scientists a request for development of any particular instrumentality which could be particularly effective in connection with some contemplated operation. This type of liaison between the scientists and the High Command is now in the United States. Its possibilities are still being explored and developed but it can be said definitely that it has already demonstrated its possibilities of great value in the war. It is a move in a desirable direction in which you have gone farther than we have gone.

National Inventors' Council. War is a great stimulus to invention, not only in the research laboratories of a country, but on the part of great numbers of its citizens, some of whom are technically competent and most of whom are uninformed but sincere in their desire to be helpful. Any actively operating research organization like the OSRD or the Naval Research Laboratory could be quickly bogged down under the deluge of ideas and inventions induced from all sources by the war. It is very important for purposes of morale that these inventors and would-be inventors be sympathetically handled. It is also important that their ideas be expertly examined to make sure that really worth-while ideas are not brushed aside, even though experience has shown that perhaps only one in one hundred thousand is new and significant.

To give such sympathetic and expert consideration and to screen the interesting suggestions out of the great mass, the National Inventors' Council was established in June, 1940, in close association with the U. S. Patent Office in the Department of Commerce, under the chairmanship of Dr. Charles F. Kettering, vice-president in charge of research for the General Motors Corporation. All suggested inventions relating to the war from any source and submitted to any agency or person in the government are channeled through this National Inventors' Council (unless they happen to come initially to an appropriate agency which is immediately interested in pursuing the matter). They pass through the hands of an expert staff of examiners who select those inventions which appear to have merit and bring them to the attention of the appropriate agency.

Office of Production Research and Development of the War Production Board. Until recently the organized war research efforts in the U. S. failed to include the very important category of research aimed at the development of substitute materials in fields where shortages exist, or of improved methods of production and manufacture. It was apparently assumed that the commercial interest of the production companies would lead them automatically to take care of this situation. However, under the pressure of war production orders, limitations of manpower and materials and financial regulations, the normal peace-time incentives to such research and development work by companies proved inadequate to meet the needs of the situation. Consequently, last September, there was established in the War Production Board an Office of Production Research and Development under the directorship of Dr. Harvey N. Davis, president of the Stevens Institute of Technology. This agency is still in the process of organization to operate somewhat along the lines of the Office of Scientific Research and Development but with primary responsibility for materials and method of production rather than devices and instrumentalities of warfare. It is regrettable that we did not have the foresight to establish this much-needed agency at a much earlier date, but it has already begun its operations and we hope that it may be enabled to play an important role during the balance of the war.

Engineering, Science and Management War Training Program. Though not directly concerned with scientific research, a review of the scientific war agencies in the U. S. would not be complete without at least a brief reference to the efforts to increase the supply of technically trained personnel to meet the increasing demand for such personnel in every field of war activity. In October, 1940, a special engineering training program was organized under the U. S. Office of Education and financed by Congressional appropriation. Later this program was extended to include also training in science and industrial management. It operates at both the collegiate and the technical school levels and its magnitude may be appreciated by the fact that, even in its first year of operation, it put through its specialized courses approximately ten times as many students as graduated in that year from the regularly established engineering colleges. Most but not all of the work was carried on in night schools, and the whole program has been decidedly helpful in relieving the technical manpower shortage.

Army and Navy Technical Training Programs. At the present time the Army and Navy are jointly establishing a very extensive program for the training of their own younger personnel in such fields as aeronautical engineering, naval architecture, electronics, communications, automotive engineering, etc., through contractual arrangements with several hundred of the nation's colleges and universities. Under these programs it is anticipated that approximately 250,000 selected young men in uniform will be detailed for this training at educational institutions during the coming year, the duration of such training to vary from field to field and individual to individual, in accordance with the needs of the situation and the performance of the individual. These special collegiate programs are intended to supplement, at the higher level, the very much larger technical training programs which the Army and Navy are conducting in their own establishments.

CONCLUSION

I conclude this factual, over-long, but I hope usefully informative address on a note of faith and optimism which I am sure is shared by the allied scientists on both sides of the Atlantic. Each of us concerned with some phase of the war effort is aware of some very significant new applications of scientific research in the war. For most of us, this knowledge is largely restricted to the special fields in which we ourselves have been working. Of necessity, the general public knows only in a vague way about some of these things and nothing at all about most of them.

When victory has been won, and the whole story of these scientific accomplishments can be told, it will indeed be a thrillingly interesting recital. Out of it all will come, not only its important contribution to victory, but a number of exceedingly significant results of permanent peace-time value. It is already evident that many of these war-time developments will have very useful peace-time applications, whose contributions to our standards of living and general prosperity and comfort will help to compensate for the ravages wrought by the war. Scientists will have a renewed faith in the worth-whileness of their work, and will continue their intellectual and practical endeavors with the increased power that has come from the experience of "team-work" on war problems. The general public, and especially the governmental and industrial leaders, will have greater appreciation of the value of science and scientists, both pure and applied—and this should result in permanently increased support of scientific research in the universities, industries and governmental agencies. These, I trust, will be some of the long-term gains to which we may look forward as the result of the temporary concentration upon practical problems of survival and victory which the war has forced upon us.

With these words of optimism, I close with the hope

that the next American Pilgrim Trust lecturer to address you may not feel obliged to discuss the war, but will be able to treat of some interesting aspect of the progress of science in accord with the original conception of Sir William Bragg and as a happy feature in the post-war forward march of science.

THE BIOCHEMISTRY OF ANTHOCYANINS

By WILDER D. BANCROFT

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A GREAT deal of work has been done all over the world on the chemistry of plant pigments. Very little work has been done anywhere on the stages through which the pigment develops in the living plant. This should be called the biochemistry of the plant pigments and is temporarily a neglected field of science. My attention has been called by Professor Bruce of Cornell to a book entitled "The Chemistry of Natural Coloring Matters" by Mayer and Cook, published in 1943. I can not find in it any information as to the probable precursors of the carotenes, to take one instance. If somebody would rewrite this book, making an exhaustive presentation of the biochemical side, he would have a masterpiece.

The red pigments in leaves, fruits and flowers and the blue pigments in flowers and fruits are mostly due to anthocyanins, though the red in the tomato, the watermelon, the berry of the mountain ash, the grape haws and the pink-fleshed Texas grapefruit is due to a lycopene. It is now known that anthocyanins are formed in plants in at least two different ways, through reduction of flavones or flavonols by ultraviolet light,[1] or through hydrolysis of what are called leuco-anthocyanins.[2] The latter reaction is often, but apparently not necessarily, accompanied by oxidation. There may be other ways of developing anthocyanins in plants; but this has not yet been proved definitely for any anthocyanin in any leaf, flower or fruit.

Light will not reduce flavones in a test-tube; but it will in some plants at some times. Therefore there must be found in some plants, under as yet unknown conditions, some substance or substances which will make flavones photosensitive. We do not yet know what this sensitizer is in any case. Flavones can be reduced electrolytically to anthocyanins,[3] but it is necessary to have a cathodic over-voltage. Consequently the reduction in the plant is undoubtedly an enzyme reaction.[4]

One important biochemical question is to determine the substance from which the anthocyanin is formed, and this has not been done in a great many cases.

With leaves which turn red in the autumn it is a relatively simple matter to test the green and then the red one so as to determine the probable precursors of the anthocyanin. This was done by Rutzler[5] in some cases. Leuco-anthocyanin appears to be the precursor in 14 per cent. of the cases. The red autumn pigments of the leaves of the sumach, the dogwood and the barberry come from a flavone and those of the sugar maple, the Virginia creeper and the Seckel pear from a leuco-anthocyanin. The leaf of the Japanese creeper, when green, contains both flavone and leuco-anthocyanin. We do not yet know which gives rise to the anthocyanin or whether both do.

When the leaves come red before they turn green, another technique becomes necessary and one was apparently devised by Abbott[6] over thirty years ago. A small copper beech was kept partially covered in the spring, and the leaves under the sacking came green. When these green leaves were exposed to the sun, red could be detected inside of two days. Abbott of course did not test the green leaves for flavones or leuco-anthocyanins. Since light turns the leaves red quickly it seems probable that flavones were present. The development of enough acid to hydrolyze a leuco-anthocyanin would probably take longer.

We do not know whether the red leaves which appear as new leaves in the tropics could come green if the leaves were shaded, as Abbott did his. The botanists and the chemists have not yet got together on this point.

With red flowers one can not usually apply the leaf technique, because it is only in a few cases that we can examine the flower before and after it has turned red. Kuyper[7] reports that the flowers of *Hibiscus mutabilis* come out white at dawn and turn red during the day. Temperature is important in producing the color change. At temperatures under 16° C. there is practically no development of pink. This makes it probable that Kuyper was dealing with a leuco-anthocyanin.

Shibada, Nagai and Kishida[8] found that the flowers of *Diervilla grandiflora* S. and Z. bloom white; but turn rose color during the day. They did not test for

[1] Bancroft and Rutzler, *Jour. Am. Chem. Soc.*, 60: 2738, 1938.
[2] Robinson and Robinson, *Jour. Chem. Soc.*, 744, 1935.
[3] Chapman, Cornell University Ph.D. thesis, 1938.
[4] Wheldale, *Jour. Genetics*, 1: 113, 1911.
[5] *Jour. Am. Chem. Soc.*, 61: 1160, 1939.
[6] *Nature*, 80: 429, 1909.
[7] Kuyper, *Rec. Trav. bot. néerl.*, 28: 1, 1901.
[8] *Jour. Biol. Chem.*, 28: 93, 1916.

a flavone; but they report that the colorless alcoholic extract produces a purple-red anthocyanin solution on reduction with mercury, magnesium and hydrochloric acid. This indicates that a flavone was present.

Sorby[9] found that by diminishing the exposure to light of a dark variety of the common wallflower, *Cheiranthus cheiri,* no anthocyanin developed, though this pigment was abundant in the flowers exposed to the sun. Apparently Sorby made no attempt to find out whether the phenomenon is general or is confined to this one flower.

We know now that the phenomenon is not general because von Sachs[10] says that "bulbs of hyacinths, tulips, etc., when germinating in profound darkness, nevertheless produce magnificent normal flowers, while the leaves at the same time become etiolated, though not strongly."

Askenasy[11] confirmed some of the results of von Sachs, but obtained a different result with *Hyacinthus orientalis.* The darkened flowers were not colorless, but they were distinctly a paler blue.

Hugo Fischer[12] says that the first appearance of color in the flower buds is generally two weeks before the time of blooming in the case of the red and blue flowers, and three to four weeks on the average with the yellow flowers. In order to minimize the disturbances of assimilation in the plants due to the cutting off of the light Fischer used small sacks or hoods of dark cloth which were not fully light-tight, but which let so little light through that one could ignore the physiological effect of the transmitted light.

When grown under a black hood the flowers of *Cydonia Japonica* [Japanese quince] were nearly pure white with just a touch of pink in the middle of each petal. Two weeks after the black hoods were taken off, the bleached flowers could not be distinguished from the normal ones.

When hooded, *Iberis umbellata* came almost completely white. *Campanula rapuncaloides, Phacelia Campanularia, Agapenthus umbellatus* and *Digitalis purpurea* were bleached somewhat, while *Althala rosea* (dark red) and *Dahlia variabilis* (double and pink) were distinctly paler but not much. On the other hand, no change could be detected with *Tradescantia virginia, Geranium pratense, Pelargonium zonale* (brilliant red) and a number of other flowers.

Although one of the yellow flowers, *Calendula officinalis,* which is a marigold, probably contains no anthocyanin, some of the petals, though not all, bleached to a pale yellow while the buttercup was unchanged.

Fischer says that there is absolutely no regularity to be found among the anthocyanins and that there seems to be no reason why one flower should bleach when grown in the dark and the other not. Fischer is ignoring possible chemical differences in the development of the anthocyanins. He could not avoid this in 1908; but we can do better now.

I read this paper by Fischer some years ago; but I read it uncritically, as apparently the other people did. I should have seen that Fischer had proved that there are at least two ways in which the plant can synthesize anthocyanin. In one case, the Japanese quince, no anthocyanin is formed when the flower is shaded; in the other case, typified by the geranium, anthocyanin is formed when the plant is shaded.

Since we know that there are two ways in which anthocyanin can be formed—[from flavones and from leuco-anthocyanins]—it seems natural to ask whether this fact will help us account for the work of Fischer and of others. If the anthocyanin is formed in the flower from a flavone it will not develop if ultra-violet light is excluded. If the anthocyanin is formed from a leuco-anthocyanin there is at present no reason to ascribe any appreciable effect to light, and the anthocyanin should form in the shaded flower. If the anthocyanin is formed in both ways in the flower, as we know it is in some leaves, we might easily get any intensity of color in the shaded flower.

It has not yet been proved that the shaded white flower of the Japanese quince contains flavone; but we know that nearly all normally white flowers do. Consequently, the white Japanese quince either contains flavones or there has been devised a method for preparing white flowers containing no flavone. While this is not theoretically impossible, the burden of proof is on the man maintaining it.

It is not clear how ultra-violet light gets into the flower bud three weeks or so before the flower blooms, and yet it must if keeping out the ultra-violet light prevents the formation.

If we water a geranium with a suitably buffered solution, perhaps a urea solution, we might be able to prevent the hydrolysis of the leuco-anthocyanin and should get white flowers which would turn red when treated with acid. I suggest urea because it is taken up readily by plant cells.

Fischer did not grow a white-flowered geranium, but he did not have any theory to guide him. Being professor emeritus I have no graduate students. Being crippled by a motor accident I can not do experimental research myself. All I can do is to point out what I think is important. I have the hope that some day it will interest some more competent person.

Somebody should extend Fischer's tests to cover all the known anthocyanins. We ought to have data on the ordinary lilac, pink carnations, peonies, oxalis,

[9] Sorby, *Proc. Roy. Soc.,* 21: 479, 1873.
[10] von Sachs, "Lectures on the Physiology of Plants," 534, 1882. Translated by H. Marshall Ward.
[11] Askenasy, *Bot. Zeitung,* 34: 1, 27, 1876.
[12] Fischer, *Flora,* 98: 380, 1908.

Christmas cactus, the red-bud or Judas tree, pink dogwood, phlox, cardinal flower, salvia and no end of other flowers. In Southern California one would include the bougainvillea.

Some red flowers, like the wild geranium, turn blue when exposed to ammonia and some do not. We do not yet know what substance should be added to the cell sap to stabilize the blue; but it should not be difficult to learn this. When we have done so, and when we have learned how to make a flavone photosensitive, we should be able to start with a plant which normally has red, white or blue flowers and make it flower either of the other two colors. We can make a hydrangea bloom red, white or blue; but this is not really a case of a patriotic posy, for we do not get the white by cutting off the ultra-violet so we are undoubtedly dealing with a different variety, as in the case of the white lilac.

It should be possible to ripen a strawberry without permitting any red color to develop. That would have no scientific value; but it would have news value.

When I was a boy we used to be told that a blackberry is red when it is green, but that is not necessarily true for a biochemist.

After the biochemistry of the anthocyanins shall have been straightened out people ought to start on the biochemistry of the carotenes and of lycopene. We know that the green tomato will turn red in the dark and of course there can be no ultra-violet light reaching the inside of the watermelon or of the pink-fleshed Texas grapefruit.

Willstätter and his successors have cleared up the chemistry of chlorophyll pretty well; but we still know very little about the biochemistry of chlorophyll.

Coming back to the anthocyanins, it is possible that zymin or reductase[13] is the enzyme or one of the enzymes that makes a flavone photosensitive. There is no proof of this as yet, but it may be true and will serve as a starting point.

SUMMARY

1. An explanation has been given for the effect of subdued light on the development of anthocyanins. This effect was observed by von Sachs and by Sorby seventy years ago. Nobody has made an exhaustive study of the subject, although Askenasy, Hugo Fischer and others have done work along these lines.

2. When a flavone is reduced to an anthocyanin, as with the Japanese quince, cutting off ultra-violet light prevents the formation of the anthocyanin.

3. When the anthocyanin is formed by the hydrolysis of a leuco-anthocyanin, cutting off of ultra-violet light will not necessarily prevent the formation of the anthocyanin. This occurs with the geranium.

4. We do not know at all approximately how many or which flowers belong to what I call the flavone type and how many or which to the leuco-anthocyanin type.

5. After the biochemistry of the anthocyanins shall have been worked out the botanists and chemists should concentrate on the biochemistry of the carotenes, the lycopenes and chlorophyll.

OBITUARY

JOSEPH SWEETMAN AMES

THE death of Dr. Joseph Sweetman Ames on June 24, 1943, brings to a close a long and eventful chapter in the history of Johns Hopkins University.

Dr. Ames' career is a striking example of a life devoted to one institution. Born on July 3, 1864, in Manchester, Vt., he went to Baltimore at the age of eighteeen to enter the university. He won his baccalaureate degree in 1886, spent a short time in study in Berlin, held a fellowship in physics at his alma mater in 1887 and 1888, was assistant in physics the two following years, and received his Ph.D. in 1890. After graduation he continued his connection with the university and rose rapidly through the positions of associate and associate professor to a full professorship in physics in 1899. Following Professor Rowland's death in 1901 he was made director of the physical laboratory. He filled this post for a quarter of a century, when he was made provost of the university. The culmination of his university career came with his appointment as president of the university in 1929. In 1934 he announced that he would retire the following year, at which time he was made president emeritus. Unhappily the period of his career as president coincided with the worst years of the depression with an increased burden of financial problems.

In only one important instance did Dr. Ames share his university allegiance with another institution. He became deeply interested in the development of aeronautics through his appointment by President Wilson as a member of the National Advisory Committee for Aeronautics in 1917. For twenty years he was chairman of the executive committee of that agency, and through his guidance the committee's facilities for aeronautical research were expanded until they now comprise three great laboratories—at Langley Field, Va.; Moffett Field, Calif.; and Cleveland, Ohio. The committee's laboratory on the West Coast is officially

[13] Paladin, *Z. physiol. Chem.*, 26: 81, 1908; *Biochem. Jour.*, 18: 15, 1909.

named in his honor, although his failing health never permitted him to visit it. In all the years of his membership in the National Advisory Committee for Aeronautics, and particularly from 1927 to 1939, when he was chairman, he made frequent visits to the committee's laboratory at Langley Field and gave to its operations the same meticulous care which characterized his university work.

Dr. Ames had the reputation of being blunt. To those who knew him well he was at heart the kindest of men. But to paraphrase one of the legends which surround the memory of Professor Rowland, Dr. Ames appeared to feel himself bound by an oath to speak the unvarnished truth as he saw it about the physical world, inanimate or not. Nevertheless, in any discussion he was preeminently fair. He would listen patiently to his adversary, whoever he might be. If he was thereby convinced that he had been in error, he would frankly admit it. If they failed to agree, he merely agreed to disagree, with no hard feeling of any kind. A meeting with a specified time schedule was to him an obligation to be met, and as chairman he carried it out to the minute, even if it left his unwary speakers gasping in the middle of a sentence, as it sometimes did. All this simply reflects the orderliness of his own mind. He had trained himself to present a subject in a logical way in a specified time and conclude it on the minute. Others could of course do the same if they would try hard enough. By sheer will power he conquered a speech impediment which troubled him much in his earlier years.

If former students of physics at Johns Hopkins were asked to name the outstanding characteristic of Dr. Ames, the answer would probably be his remarkable ability as a teacher. He was not primarily an experimentalist. In fact, the literature of physics contains very few investigations under his name. He was first and foremost a teacher in accordance with the best traditions of the university. The wide use of his text-book on "General Physics" was a tribute to the clarity of his exposition. He followed closely new theoretical and experimental advances in physics, and made every effort to keep his students informed regarding current developments. The journal meetings and seminars of the physics department under his personal direction were inspiring occasions, and the habits of thought there developed were destined to have a deep influence on the students who were privileged to participate.

So firmly did Dr. Ames hold to the importance and obligations of teaching that he continued to give his undergraduate courses in physics long after he became director of the physical laboratory. His classroom lectures were masterpieces of straightforward logical presentation. Even in his graduate courses he seldom referred to his notes. In his Joseph Henry Lecture before the Philosophical Society of Washington, which necessitated a manuscript for publication, he laid aside his manuscript at the beginning and presented his subject in characteristic style.

Dr. Ames was a member and past president of the American Physical Society; a member of the National Academy of Sciences; a fellow of the American Academy of Arts and Sciences and honorary member of the Royal Institution of Great Britain. He received the Langley Gold Medal in 1935 in recognition of his leadership in developing aerodynamic research. Washington College, the University of Pennsylvania and Johns Hopkins honored him with the degree of doctor of laws. He was a member of the Baltimore School Board and was president of the Baltimore Country Club for twenty years.

In 1899, Dr. Ames married Mrs. Mary B. Harrison. There were no children of this marriage, but he was deeply attached to his three step-children. Their home on Charlecote Place, Guilford, was a delightful place to foregather. He was a kindly and genial host and a skilful raconteur. After the death of Mrs. Ames in 1931 Dr. Ames lived alone in his home in Guilford until the end. A great teacher has passed to the realm of memory.

LYMAN J. BRIGGS

RECENT DEATHS

DR. WILLIAM FOGG OSGOOD, emeritus professor of mathematics of Harvard University, died on July 22 at the age of seventy-nine years.

DR. CARL EDWIN LADD, dean of the New York State College of Agriculture, Cornell University, died on July 23 at the age of fifty-five years.

DR. GEORGE FREDERICK KAY, professor of geology at the State University of Iowa from 1907 until early this year, dean of the College of Liberal Arts from 1917 to 1941, died on July 20 in his seventieth year.

DR. AGNES LOW ROGERS, formerly professor of education and psychology at Bryn Mawr College and director of the Phoebe Ann Thorne School, has died in Scotland. She was in her fifty-ninth year. Dr. Rogers had been professor of educational psychology at Goucher College and at Smith College.

DR. GEORGE ABRAM HARTER, professor emeritus of mathematics of the University of Delaware and president of Delaware College from 1896 to 1914, died in his ninetieth year on July 22.

CHARLES H. STERNBERG, collector of fossils and a contributor to museums in Munich, London, Paris, New York and Toronto, died on July 20. He was ninety-three years old.

DR. LEONARD S. MCLAINE, Dominion entomologist and assistant director of the science service of the Department of Agriculture, Ottawa, died on July 20 at the age of fifty-six years.

SCIENTIFIC EVENTS

MESSAGE FROM CHINESE MEN OF SCIENCE[1]

PROFESSOR TSENG CHAO-LUN, head of the department of chemistry of the National Southwest Associated University, Kunming, China, has sent the following open letter to British scientific men:

While the introduction of modern science into China dates back to eighty years ago, the real beginnings of scientific research in China came after 1919. On May 4 of that year, students in Peiping (then still called Peking) demonstrated against Japanese aggression, and from that incident was evolved the so-called "May 4th Movement," so important in the cultural as well as the political history of modern China. That movement, which quickly spread all over China, not only rallied the country to the standards of democracy but also promoted the natural sciences as factors in the modernization of China. With this impetus, scientific education and scientific research developed at a rate never dreamed of before. The progress made between 1929 and 1937 was particularly rapid, and constant encouragement was received from scientific workers in the United States and in Europe. Since the outbreak of the Sino-Japanese War in 1937, scientific institutions and scientific men in China have suffered tremendously through the deliberate efforts of the Japanese to destroy Chinese culture. But here in the hinterland of Free China, Chinese men of science have been laboring hard for the last five years in the interest of China and of science.

Chinese scientific workers owe much to Great Britain for their training. For both democratic ideals and scientific accomplishment, we have always looked to Great Britain for guidance. Now, under the banner of the United Nations, Britain and China are fighting shoulder to shoulder to save democracy for the world; a new era of cooperation between the British and Chinese peoples has begun. Early this year we had the honor of welcoming a cultural mission from the British Council. One of its members is Dr. Joseph Needham, who is now doing most valuable work in our country, and who brought with him a large number of scientific books so much needed by us. Recently, Chinese science students in Britain, with the help of the British Ministry of Information, the British Broadcasting Corporation, the British Council and other organizations, have started a scheme for sending us science news, which includes a weekly broadcast summary of the principal contents of each week's issue of *Nature;* recent valuable scientific publications and microfilm copies are being sent, and scientific books are being collected with the view of establishing an adequate Science Library in China. Many British men of science are helping in these efforts. We shall never forget such things, and we hope they will develop into a bigger scheme of cooperation between the scientific men of Great Britain and China.

[1] From *Nature.*

THE AQUARIUM OF THE ZOOLOGICAL PARK, LONDON

The Times, London, writes:

One of the most popular pre-war attractions of the London Zoo, the aquarium, was reopened on June 11 in time for the Whitsun holidays.

It had been closed since the beginning of the war for fear of the possible consequences if a bomb should hit one of the big tanks, water from which might then have flooded the tunnels used as air-raid shelters. So the exhibits were removed, and the sea-water was emptied from the tanks into the Regent's Canal—by which it used to reach the Zoo in barges after coming from the Bay of Biscay as ballast in ships' holds. Some time later a German bomb did in fact fall through the roof of the aquarium.

In response to many inquiries by the public the fresh-water section of the aquarium has now been reconstituted, though necessarily on a more modest scale than before. The exhibition reflects much credit on the aquarium overseer, Mr. H. Vinall, who has got it together in face of many difficulties. He himself has made fishing excursions, with a drag-net, to acquire many of the British fresh-water fish now on view. Among them are trout, perch, roach, dace, bream, tench, carp and eels.

The other exhibits are survivals from the pre-war aquarium and have been stored behind the scenes in tubs and all manner of receptacles. Most are cold-water fish, but the exhibition also includes five tanks of tropical fish, kept warm by electrical elements in the water. Some of the most vivid little tropical fish have been on view for the past year in the neighboring reptile house, which provides a suitable temperature for these miniature wonders of the deep, and they will remain there.

In warm-water tanks in the aquarium are several species of cichlid and two lung-fish, one from Africa, the other from Australia. There are salamanders from China and Japan, American garfish and sunfish, the Mexican axolotl (which is capable of living on dry land) and a fine display of ornamental gold-fish. At the entrance is a large and attractive ornamental pool, inhabited by large carp and golden orfe.

THE RESOURCES OF VIRGINIA

UNDER "Science Notes" in *The Commonwealth* Dr. Sidney S. Negus reports that a committee has been appointed by W. Catesby Jones, president of the Virginia Academy of Science, to prepare an inventory of Virginia resources, including minerals, soils, agriculture, water, forestry, water power, transportation, labor, education, manufacturing, finances, research,

climate, markets and specialized human resources such as in the field of scientifically trained manpower. Committees in other Southern states will do the same for their respective areas, the final data to be assembled by the Southern Association of Science and Industry.

Dr. Marcellus H. Stow, head of the department of geology at Washington and Lee University and now on leave of absence with the War Production Board, and Clarence W. Newman, director of research of the Virginia State Chamber of Commerce and editor of *The Commonwealth,* are co-chairmen of the Virginia committee. Other members are Dr. Arthur Bevan, state geologist; T. E. Clarke, director of the Commission of Game and Inland Fisheries; Dr. T. B. Hutcheson, professor of agronomy, Virginia Polytechnic Institute; Dr. George W. Jeffers, professor of biology, Farmville State Teachers College; Raymond V. Long, director of the Virginia State Planning Board; Dr. Curtis L. Newcombe, director of the Virginia Fisheries Laboratory, and F. C. Pederson, state forester.

Dr. Negus states that there has also been appointed a committee to promote the incorporation in the school text-books of Virginia of information regarding the natural resources of the State and the South. Members of this committee are Francis S. Chase, secretary of the Virginia Education Association; Hubert J. Davis, chairman of the Virginia Junior Academy of Science; Dr. K. J. Hoke, head of the department of education, College of William and Mary; Dr. Dabney S. Lancaster, superintendent of public instruction for Virginia; Dr. Ivey F. Lewis, dean of the University of Virginia; and Dr. Wortley F. Rudd, dean of the school of pharmacy, Medical College of Virginia, chairman. There will soon be added to this committee a woman member. The Southern Association of Science and Industry hopes to have a similar committee in each State of the South.

RARE CHEMICALS

THE following chemicals are wanted by the National Registry of Rare Chemicals, Armour Research Foundation, 33rd, Dearborn and Federal Streets, Chicago, Ill.:

1. Copper Selenite Dihydrate (pure grade free from nitrogen)
2. Titanium Oxy Sulphate
3. Pure Estriol (Theelol) (500 mg)
4. Pure Indene (500 g)
5. Phlorhidzin (Phlorizin)
6. Parinoic Acid
7. Biallyl (1,5 Hexadiene)
8. Deca Tetra Enoic Acid
9. Octa Trienoic Acid
10. 1–3 Pentadiene
11. Ethyl Allene
12. P-Chlorobenzaldehyde
13. Dihydroxy Maleic Acid
14. Cyclopentene
15. Propargyl Chloride
16. Tetramethylene (Cyclobutane)
17. Vinyl Ether
18. Vinyl Ethyl Ether
19. Propyl Nitrite

GIFTS AND GRANTS TO THE UNIVERSITY OF WISCONSIN

GIFTS and grants amounting to $108,650, of which $80,800 was from the Wisconsin Alumni Research Foundation, were accepted by the Board of Regents of the University of Wisconsin at its last meeting.

The large sum from the foundation was in the form of two grants, one for $77,500 to support university research during 1943–44, and the other for $3,300 for the renewal of a research fellowship to study the irradiation of dairy products and experimental work on vitamin D concentrates in the departments of dairy industry and biochemistry under the supervision of Professors H. C. Jackson, K. G. Weckel and Harry Steenbock.

The $77,500 grant to support university research is divided as follows: aid to professorial research, $25,000; symposium, $5,000; chemical engineering, $10,000; and unassigned assistantships and apprenticeships, $37,500.

Other gifts and grants were:

International Cancer Research Foundation, Philadelphia, Pa., $9,000, for renewal of a grant to carry on a study of the pathological cell multiplication in plants for a three-year period under supervision of Professor A. J. Riker.

The National Canners Association, $7,200, for renewal of research to determine the vitamin content of canned foods under supervision of Professor C. A. Elvehjem and F. M. Strong.

The Dr. L. D. LaGear Co., $2,500, for an industrial fellowship for a study of poultry diseases under Professors C. A. Herrick and James G. Halpin.

National Dairy Council, Chicago, $3,000, for the renewal of the third industrial fellowship for research on butter fat under Professors C. A. Elvehjem and E. B. Hart.

National Cheese Institute, Chicago, $2,000, for establishment of a third industrial fellowship to make a study of cheddar cheese under Professors M. J. Johnson, W. C. Frazier and W. V. Price.

Ludlow Manufacturing and Sales Co., Boston, Mass., $2,000, for the renewal of an industrial fellowship in the department of agronomy for the study of hemp under Professor A. H. Wright.

Grants of $500 and under were accepted from the American Medical Association, Chicago, from Yahr-Lange, Inc., Milwaukee, and from the Pure Milk Association, Chicago.

THE NEW PREFERENCE AND LIMITATION ORDER ON LABORATORIES AND LABORATORY EQUIPMENT

SCIENCE has received from E. H. Schaar, of Schaar and Company, Chicago, a copy of a circular letter explaining the new Preference Rating Order P–43 and Limitation Order L–144, together with copies of these two orders. He states that the circular was mailed to about 15,000 individuals in educational, governmental, institutional and industrial laboratories all over the country. It reads:

On June 26, 1943, both Preference Rating Order P–43 and Limitation Order L–144 were revised completely. Since both of them directly affect your purchases of laboratory supplies, we want to tell you about the many new provisions. Enclosed are copies of the two Orders; we urge you to study them carefully. Note especially these points, which are of particular interest:

1. P–43 assigns a rating of AA–1 to serial-numbered laboratories, and a rating of AA–2 to all other laboratories.

2. Laboratories engaged in research or production control essential to the war effort may obtain a serial number.

3. Laboratories which already have a P–43 serial number may continue to use it. Those which do not may apply to WPB on form WPB–167.

4. Certain items may be purchased only with approval from WPB (see L–144, List A; apply on form WPB–1414).

5. Laboratories which do not have serial numbers must obtain WPB approval (using form WPB–1414) to place a single order for $200 or more, or to buy $50 or more of a single item.

6. If you are still waiting for delivery of any orders placed with us, rerate them at once in accordance with these new rulings. By rerating them promptly, you will materially expedite delivery, in many instances.

7. If you do not already have a serial number, and if you believe you are eligible to obtain one, apply for one right now.

We shall be glad to give you any additional information we can, and to send copies of any of the forms you may wish to have. Just let us know how we can help.

THE MATHEMATICAL ASSOCIATION OF AMERICA

THE twenty-sixth summer meeting of the Mathematical Association of America will be held at the New Jersey College for Women, Rutgers University, New Brunswick, N. J., on Saturday and Sunday, September 11 and 12, in conjunction with the summer meeting and colloquium of the American Mathematical Society and the meeting of the Institute of Mathematical Statistics. Three sessions of the association will be held on Saturday, beginning at 10 A.M., 2 P.M. and 8 P.M.

The sessions of the American Mathematical Society will be held on Sunday and Monday. Three colloquium lectures will be given by Professor E. J. McShane, of the University of Virginia, the subject being "Existence Theorems in the Calculus of Variations." These lectures will be given at 9 A.M. on Sunday and at 9 A.M. and 2 P.M. on Monday. At 2 P.M. on Sunday Professor Antoni Zygmund, of Mount Holyoke College, will give an address on "The Complex Method of the Theory of Trigonometric Series."

The Institute of Mathematical Statistics will hold sessions on Sunday at 10:15 and 3:15 and on Monday at 10:15 A.M. there will be a joint session of the society and the institute.

On Sunday evening at 6:30 there will be an informal buffet supper for the three organizations at Wood Lawn, the Alumnae House of New Jersey College for Women. Following this supper at 8:30 P.M. the department of music of the New Jersey College for Women will give a musicale in the Music Building.

The Board of Governors of the association will meet at 10:15 A.M. on Sunday, September 12.

THE PRESIDENT OF THE SOCIETY OF CHEMICAL INDUSTRY

WALLACE P. COHOE, of New York City, has been elected president of the Society of Chemical Industry, according to word received from the international headquarters of the society in London. Mr. Cohoe, who is technical adviser to corporations, principally in the fields of textiles, synthetics, paper and cellulose, succeeds Dr. William Cullen, chemical consultant of London, who for more than half a century was associated with the Nobel Explosives Company, Ltd., of Glasgow and South Africa.

Dr. Cullen, who will serve as chairman of the council during the administration of Mr. Cohoe, states that closer world relations among industries employing chemists and chemical engineers will be a chief objective of the society in the coming year.

The Society of Chemical Industry, founded in 1881, has approximately 5,000 members throughout the world. It is composed of eighteen sections. England has eleven sections, Canada five, the United States one and Australia one. The chairman of the American section is Dr. Foster D. Snell, of Brooklyn, N. Y. Mr. Cohoe is planning a trip to England to develop a program for the expansion of the activities of the society. Sections will be established in New Zealand, South Africa and India after the war. He will visit all Canadian sections to coordinate their work with that of the American and other British sections. He has been vice-president of the Society of Chemical Industry and chairman of the American and Canadian sections. He is a member of the American Chemical

Society, the American Institute of Chemical Engineers, the American Institute of Chemists and the American Association for the Advancement of Science.

Mr. Cohoe, who was born in Norwich, Ontario, in 1875, is the sixth American president of the society. The others were Dr. C. B. Chandler, Dr. William H. Nichols, Professor Ira Remsen, Professor Marston T. Bogert and Dr. Arthur D. Little.

SCIENTIFIC NOTES AND NEWS

DR. GEORGE D. BIRKHOFF, Perkins professor of mathematics at Harvard University, has been elected an honorary fellow of the Royal Society of Edinburgh.

DR. KENNETH E. CASTER, assistant professor of geology and fellow of the Graduate School of Arts and Sciences of the University of Cincinnati, has been elected a corresponding fellow of the Instituto de Estudios Superiores of Uruguay.

THE National Society for the Prevention of Blindness has awarded the Leslie Dana Gold Medal, given annually "for outstanding achievements in the prevention of blindness and the conservation of vision," to Dr. Walter B. Lancaster, of Boston, consulting ophthalmic surgeon at the Boston City Hospital, the Massachusetts Eye and Ear Infirmary and the Massachusetts General Hospital, in recognition of "long meritorious service." Dr. Lancaster, though eighty years old, is in active practice as an ophthalmologist. The award is given by the St. Louis Society for the Blind on the recommendation of the Association for Research in Ophthalmology.

A LIST of honors to Canadians conferred by the King of England "on the occasion of the celebration of his birthday and on the advice of Canadian Ministers," as given in *Nature*, includes the following names: *C.M.G.:* Professor C. J. Mackenzie, acting president of the National Research Council of Canada; Professor W. G. Penfield, head of the Neurological Institute, Montreal. *C.B.E.:* Dr. A. E. Archer, president of the Canadian Medical Association; Professor J. B. Collip, president of the Royal Society of Canada; W. E. Phillips, president of Research Enterprises, Ltd.

DR. E. W. SMITH, president-elect of the British Institute of Fuel, has been awarded the Birmingham Medal of the Institution of Gas Engineers, in recognition of "his outstanding work during the past thirty years for the gas industry."

A WIRELESS to *The New York Times* reports that honorary fellowships awarded by the Royal College of Surgeons, London, and presented at a reception given on the evening of July 21, include the following Americans: Colonel Elliot C. Cutler, Moseley professor of surgery, and Dr. R. B. Osgood, professor of orthopedic surgery, at Harvard University; Dr. Evarts A. Graham, professor of surgery at the Medical College of Washington University, St. Louis, and Dr. Howard C. Naffziger, professor of surgery in the Medical School of the University of California, San Francisco, chairman of the sub-committee on neurological surgery of the National Research Council. Dr. Naffziger was the only American present at the reception at which the awards were made. On this occasion a message was received from the King of England, who sent his best wishes to the college and expressed his hope that its museum, damaged by a German bomb two years ago, would be restored as soon as possible after the war.

PROFESSOR ARTHUR G. RUGGLES, after forty-one years of service in the division of entomology of the University of Minnesota, retired from active service on June 30. For twenty-five years he served in the dual capacity of teacher and state entomologist. He continues work in the State Department of Agriculture in an advisory capacity.

AT the Medical School of the University of Minnesota, Dr. Harold A. Whittaker has been promoted to a clinical professorship of preventive medicine and public health; Dr. Ralph T. Knight to a clinical professorship of anesthesia, and Dr. Wallace D. Armstrong to a professorship of physiological chemistry.

DR. DONALD DUNCAN, professor and head of the department of anatomy of the School of Medicine of the University of Buffalo, has been appointed professor of anatomy at the School of Medicine of the Louisiana State University.

DR. JOHN R. MOHLER, chief of the Bureau of Animal Industry of the U. S. Department of Agriculture, has retired after serving in the bureau for forty-six years. He will be succeeded by Dr. Arthur W. Miller, assistant chief of the bureau since 1928.

WITH the retirement on July 1 of W. W. Mackie, agronomist in the Agricultural Experiment Station of the University of California at Berkeley, the activities of the division of agronomy have been transferred to Davis. Dr. Mackie is on leave from the university, to assist the Imperial Rice Growers Cooperative Association as consultant in the production of rice.

DR. E. B. KRUMBHAAR, professor of pathology at the University of Pennsylvania, has been appointed a member of a committee of the Harvard Overseers to visit the Medical School and the Stillman Infirmary.

ROBERT W. HODGSON, professor of subtropical horticulture in the College of Agriculture of the University of California at Los Angeles, has succeeded Dr. William H. Chandler as assistant dean of the college.

DR. ERWIN V. MOORE, a veterinary physician of Cortland County, has been named an assistant state agricultural commissioner of New York. Dr. Moore is a son of Veranus A. Moore, a former dean of the New York State College of Veterinary Medicine. Earl C. Foster, of Clinton, has also been named an assistant commissioner.

DR. R. P. DINSMORE, since 1939 development manager of the Goodyear Tire and Rubber Company, who until recently served as assistant deputy director of the synthetic rubber program of the Government, has been elected vice-president of the company in charge of research and development.

PROFESSOR MAURICE L. TAINTER, of the department of pharmacology of Stanford University, has become research director of the Winthrop Chemical Company, Inc., Rensselaer, N. Y.

Chemical and Engineering News reports that Dr. Hans F. Winterkorn, of the University of Missouri, has become associate professor in civil engineering at Princeton University, where in addition to teaching he will be in charge of a research project sponsored by the Civil Aeronautics Administration on chemical stabilization of airdrome soils.

DR. ROBERT M. HERBST, professor of organic chemistry at New York University, has become director of research for the firm of E. Bilhuber, Inc., Orange, N. J.

IT is reported in *Chemical and Engineering News* that Otto A. Reinking, head of the division of plant pathology of the New York State Agricultural Experiment Station, has joined a mission to Costa Rica, where it is hoped to establish a quinine industry.

DR. PHILIP WORK has resigned as professor of neurology and head of the department at the School of Medicine at Denver of the University of Colorado, to become a lieutenant colonel in the Medical Corps of the Army.

DR. WILLIAM W. KRAUSS recently gave a series of four lectures on race biology under the auspices of several departments of the University of Colorado and the Colorado chapter of Sigma Xi. The series comprised lectures on European race problems, the Negro and mulatto problem, the races of the Far East and race-crossing in Hawaii.

DR. KARL LARK-HOROVITZ, head of the department of physics at Purdue University, gave a series of lectures on physics, its application to chemistry and biology and the teaching of science, under the auspices of the Research Council of Iowa State College on July 22, 23 and 24.

THE seventy-third annual convention of the American Institute of Civil Engineers was held at Los Angeles, Calif., on July 28, 29 and 30.

THE fourth Conference on Science, Philosophy and Religion in their Relation to the Democratic Way of Life will be held at Columbia University from September 9 to 13.

THE annual summer meeting of the Pennsylvania Academy of Science will be held at Reading on Friday and Saturday, August 13 and 14. Meetings will be held at Albright College and at the Reading Museum. Geological and botanical field trips are planned to Mt. Penn and vicinity.

THE National Foundation for Infantile Paralysis has made a five-year grant of $175,000 to the University of Minnesota for a special study of the effects of the disease on the human body and methods of treating it. The Minnesota unit is the fourth long-range research project set up. The others are at the Johns Hopkins University, Yale University and the University of Michigan.

THE Medical School of the University of Minnesota has received an annual appropriation from the State Legislature of $15,000 for special research in the field of cancer. The school has also received a continuation of the grant of $10,000 a year by the Citizens Aid Society in support of cancer research and the program of cancer education, and the continued annual gift of $5,500 by the Citizens Aid Society in support of the George Chase Christian professorship in cancer research; a grant of $5,000 from the Jane Coffin Childs Memorial Fund for Medical Research has been made for the support of the work of Dr. John J. Bittner and Dr. Robert G. Green and associates in the departments of physiology and bacteriology on the nature and mode of action of the milk influence in mammary cancer; a grant of $3,500 a year for a two-year period has been made by the Commonwealth Fund of New York toward the support of the Psychiatric Clinic for Children. Toward the support of this clinic the Stevens Avenue Home of Minneapolis will continue its grant of $10,000 for the year beginning July 1, 1943; a grant of $3,000 has been made by Parke, Davis and Company to establish a fellowship in clinical hematology in the department of anatomy, under the supervision of Dr. Hal Downey.

TWO grants amounting to $9,000 have been made to Stanford University for the use of the department of biology in research on plant heredity in relation

to food essentials. The Research Corporation of New York has given $3,000, which will be used during the summer in the work of finding mutant strains not now available. The Nutrition Foundation, Inc., has renewed a grant of $6,000 to provide four fellowships for work in developing specific microbiologic assays, primarily for amino acids.

ANNOUNCEMENT is made that Mead Johnson and Company has renewed the arrangements for a period of five years whereby the annual award of $1,000 will be given for research dealing with vitamin B complex. The recipient of this award will be chosen by a committee of judges of the American Institute of Nutrition.

IT is reported in *The New York Times* that trustees of the Wisconsin Alumni Research Foundation have decided to ask the Ninth Circuit Court of Appeals at San Francisco to re-study a ruling declaring that valuable patents covering the manufacture of Vitamin D are invalid. If the court does not reverse its ruling, the foundation will ask the United States Supreme Court for a review.

A CABLE to *The New York Times* states that according to Professor Eligio Ocana Vieto, first secretary to the Ministry of Education of Panama, the sum of $4,000 will be contributed monthly by the National Government of Panama for the organization and maintenance of an Inter-American University. This, it is said, will provide for five professorships and twenty scholarships offered by the Government to students of the American Continent. The university will be opened on September 27, coinciding with the opening of the Congress of the Ministers of Education of American Countries. The University of Notre Dame, Indiana, has offered to endow a chair in philosophy under a professor who would go to Panama every year.

THE daily press, quoting from an article in the Stockholm newspaper *Svenska Dagbladet,* states that the value of the Nobel Prizes in 1943 will be 123,690 kroner each ($30,922 at par). The value in 1942 was 131,891 kroner (about $32,972) each and, in 1941, 131,496 kroner (about $32,874).

DISCUSSION

CENSUS AREAS FOR THE UNITED STATES, 1940

FOR a decade Ex-Governor C. S. Osborn, of Michigan, and his daughter, Stellanova Osborn, have, with unbelievable endurance, pursued the Census Bureau, the Library of Congress, the Geological Survey, the General Land Office and even the American Geographical Society to have them "give back to Michigan" the water area of the adjoining Great Lakes which these agencies, one may be surprised to learn, never denied her. After much indecision the guilt for this deed finally has been fixed on the Census Bureau and, because SCIENCE chooses to publish the Osborn viewpoint, we wish to reply, although this brief statement does not do justice to the voluminous correspondence with the Osborns and their many staunch Michigan friends.

As might be expected, the Census Bureau and the principal map-making agencies of the Federal Government have not always been consistent in their manner of publishing State areas during the nearly one hundred years of the history of area measurement in the United States. The process has been evolutionary with the development of techniques, maps and needs. The areas published by the General Land Office during the second and third quarters of the nineteenth century excluded large water bodies such as the Great Lakes. Henry Gannett, geographer of the Census on loan from the Geological Survey, in 1881 published the first basic area measurements of the States and counties of the United States. He gave "gross areas" for the States and included the area of Chesapeake and Delaware Bays with the adjoining States but omitted all reference to the subdivision of that portion of the Great Lakes area under the jurisdiction of the United States. This manner of presentation was retained for each decennial census until 1906, when Gannett thought better of his omissions and listed, below his main table, the several States and the amount of Great Lakes water area "contained" by each. This method of presentation was retained by Gannett as well as by C. S. Sloane, who succeeded him as geographer of the Census, and Frank Bond, of the General Land Office, on those rare occasions when water areas were even published, until the current remeasurement for the Census of 1940.

It is incorrect to suppose that the latest remeasurement of the United States represents a slavish adherence to a traditional form of presentation. The presentation used was the outgrowth of extended discussion with professionally qualified cartographers, geographers, geodesists of the Federal map-making agencies and private scientific organizations. A special committee of the National Research Council gave consideration to this matter and a quotation from the report of this committee, dated May 3, 1941, is significant:

In the interest of keeping our statistics of area upon the basis usual in foreign countries it was concluded that the Great Lakes areas, Long Island Sound, Delaware Bay, Chesapeake Bay, Puget Sound, and the Straits of Juan de Fuca and Georgia, etc., should be excluded from the inland waters in the main table but presented in footnotes with the water areas of the several States.

The latest remeasurement of the United States represents a more basic departure from the past than the above decision might indicate. For the first time three fundamental definitions for land, inland water and water other than inland water were established. The application of these mutually exclusive definitions makes it possible for any one to duplicate the outer limits established for the United States and solves the vexatious problem, among others, of how to handle the hundreds of islands off the coasts of Maine and Florida. Finally, as facts that Mr. Osborn failed to note, not only does Map I, "Limits of the United States," contained in the Census publication "Areas of the United States: 1940," show that the current measurements were made to the International Boundary, but Table IV lists the Great Lakes area contained within each State. This gives full recognition to the fact that the Great Lakes to the International Boundary are under the legal jurisdiction of the United States and the adjoining States.

It is true, and properly so, that the Census Bureau is primarily a statistical agency. The funds which it spends are for collecting, analyzing and publishing statistics covering a wide range of subjects. The fact that Census areas have been vested with official, quasi-legal authority, over and above their service to statistics, is an evolution over which the Census Bureau has had no control. The U. S. General Land Office has the authority to make surveys and area determinations of a highly accurate legal character, based on actual field work. As for Census areas, at present they are as accurate as is feasible with national coverage on a map scale of 1:500,000, using geodetic tables for 30-minute quadrilaterals of latitude and longitude and careful planimeter measurements. Census areas will undergo revision each decade as improved, larger-scale maps are produced. It would be folly indeed if through the suggestion of Ex-Governor Osborn, Michigan should seek to legalize and constitutionally adopt a Census area for its State (with the Great Lakes area to the International Boundary included), when under the circumstances of measurement from the maps available, a gross error of one per cent. is to be expected, and future revisions are a certainty.

The areas to which Census statistics pertain are almost without exception land areas. The manner in which areas serve the census function is to enable users of statistical data to compute square mile densities for inter-area comparison. Small bodies of inland water too partake of a character analogous to land area from the statistical standpoint. But, in order not to be misleading statistically, it is considered appropriate to exclude large water bodies from inland water. For one thing, imagine the confusion of attempting to divide Lake Michigan among the adjoining counties of the four abutting States, and then to further subdivide this water among the minor civil divisions of these counties. Yet, if the distinction between "inland water" and "water other than inland water" (the Great Lakes and other large bodies of water) had not been made this procedure would have been required, no matter how ridiculously impracticable. Furthermore, it seems appropriate to avoid publishing areas in such a manner as to arouse a storm of legal and political controversy, yes, and manifestations of State patriotism! There is an American phobia for bigness. Michigan with her Great Lakes water area expands from 58,216 to 96,791 square miles; from the State listed as 21st in size to that of 9th in size; from the second largest State east of the Mississippi to by far the largest. These matters might seem trivial, but many a tempest has started in just such a teapot. Might not other States, Georgia, for instance, insist that the Census remeasure their areas and force the inclusion of coastal water areas to which they feel they have a legal claim. Where might this indoor sport lead? We believe the Census is right in avoiding such hair-splitting arduous labor. For those who do not believe that such controversies are latent, here are some of the facts and some of the fiction in the case:

California claims jurisdiction over all Pacific waters lying within 3 English miles of her coast; Oregon claims jurisdiction over a similar strip of the Pacific Ocean, one marine league in width between latitude 42° north and the mouth of the Columbia River; Texas claims jurisdiction over a strip of Gulf water 3 leagues in width, adjacent to her coast and between the Rio Grande and the Sabine River; the counties of New Jersey fronting upon the sea-coast extend, by statute, 3 nautical miles from the shore line; and Louisiana has passed legislation claiming a 27-mile limit. The remaining 16 states bordering the Pacific or Atlantic Oceans or the Gulf of Mexico either make varying claims or have entered no claims whatever to territorial waters. No certainty in international law exists relative to the limits of the territorial sea and there has been wide divergence of opinion. The United States, for fishing rights, uses a 3-mile limit and the revenue laws pushed the line for customs waters out to 4 leagues from the coast. During the prohibition era, jurisdiction was extended to a 12-mile

limit and beyond, whereas now we are speaking of the limits of the Western Hemisphere. Russia claims a 12-mile limit, Italy a 6-mile limit, Norway and Sweden 4 marine miles and the United Kingdom 3 miles, and none of these powers agree on the manner in which their limits should be applied to the irregular shore line or embayments of their countries.

To be sure, some day these and all other problems of a kindred nature may be solved. But these are assignments for the Attorney General's Office, the Supreme Court and the State Department and are far afield for a statistical agency like the Census Bureau!

One further point needs clarification. It is true that the Canadian Census included the water area of the Great Lakes to the International Boundary in the total for the Province of Ontario. Canada is entitled to any manner of presentation which it may choose. However, the principal work of area measurement has been done in Europe and in the United States. Area measurement in Europe has not included the Caspian, Aral and White Seas, and the Sea of Azov in the total area of Russia; the various portions of the Baltic Sea have not been included within the total for Germany, Denmark, Sweden and Finland; the Sea of Marmara is not included in the total area of Turkey; and the Mediterranean and Black Seas are not treated as inland water, although their character certainly is inland or landlocked. T. Willers in *Petermanns Mitteilungen,* Ergänzungsheft Nr. 170, 1911, gives additional detail. The treatment of The Netherlands on page 1145 of the Statesman's Year-Book, 1940, is indicative of standard treatment.

C. E. BATSCHELET
M. J. PROUDFOOT

RIBOFLAVIN–VITAMIN B_2 IN SOIL[1]

LAST year while studying the occurrence of vitamins in fungi, on which a brief report was published in the June 16, 1942, issue of SCIENCE, the question was raised as to whether there was a possibility of finding vitamins in soil. Most of the molds studied, such as species of Aspergillus, Penicillium and Fusarium, gave positive tests for thiamin and riboflavin. Having cultured many soils in our mycology and soils laboratories and finding species of these genera in practically every culture, it seemed worth while to investigate whether soils contained vitamins. To date these investigations have been mostly confined to qualitative tests for vitamins B_2 or riboflavin.

Soil extracts were obtained by placing 25 grams of soil in a 250 ml Erlenmeyer flask, then adding 150 ml of 0.25 N sulfuric acid; this was attached to a digesting apparatus or autoclaved for an hour and the resulting solution decanted. All operations had to be carried on in a darkened room due to the fact that riboflavin breaks down in presence of light.

After the extract was obtained the following tests were applied to determine the presence of B_2-riboflavin.

(1) The method proposed by H. Kahler and E. P. Davis[2] where the B_2 is destroyed in solution by adding NaOH until a solution pH of 11 is reached. Our soil extracts, when adjusted by concentrating or diluting to read about 100 on the fluorophotometer and adding sufficient alkali to destroy the riboflavin, would drop to a reading of 30 to 40.

(2) The microbiological method used of determining riboflavin was outlined in the *Journal of the Association of Official Agricultural Chemists,* for May, 1941. Our *Lactobacillus casei* culture (Type 7469) was obtained from the America Type Culture Collection last summer. Quantitative tests were set up comparing the soil extracts with known amounts of riboflavin, and check sets without riboflavin. This biological method gave positive tests for this vitamin from many local soils.

From the work done at present, we believe that occurrence of B_2 is correlated with the amount of organic matter in the soil. Whether the vitamin comes from the breakdown of plant tissues or whether it is synthesized by fungi, or from both, remains to be determined.

The fact that vitamins are present in the soil does not mean that these vitamins are used in plant growth. We might have a system operating, comparable to the nitrogen cycle with its involved stages; also it seemed quite possible that plant roots might not be able to absorb the riboflavin molecule from the soil solution.

We decided to see if we could obtain any information regarding the question as to whether plant roots absorb the vitamin molecule. To do this, greenhouse plants from the species available were selected in pairs. The two plants used in each case were as nearly identical as possible. These were taken to the dark room and the tops removed, leaving stems about one half inch tall to which were attached pipettes by using rubber tubing long enough to make connections. One plant of each pair was watered with a 25,000 to 1 concentration of riboflavin and the other member of each pair was given distilled water. The root sap was collected in the pipettes and was tested by the *L. casei* biotest mentioned above for riboflavin. These results when subjected to statistical analysis agreed that the plant roots watered with riboflavin solution produced root sap that contained several times the riboflavin found in the root sap where distilled water was used.

[1] I gratefully acknowledge indebtedness to Edwin Schmidt and Beth Booth for assistance in carrying on various phases of these studies.

[2] H. Kahler and E. P. Davis, *Proc. Soc. Exp. Biol. Med.,* 44: 604, 1940.

The plants used for this determination were tomato, tobacco, fuchsia and carrots.

The studies made to date indicate that certain vitamins, particularly B_2 or riboflavin, are present in the soil and that some plants take up vitamins from this source as they absorb essential mineral elements.

If any of our crop plants supplement their synthesized vitamins with vitamins from the soil at different growth stages the presence or absence of vitamins in the soil immediately becomes a vital factor in crop production and soils management.

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APPARENT TIME ACCELERATION WITH AGE OF THE INDIVIDUAL

THE apparent acceleration of time as one grows older seems a rather universal experience. All of us can recall what a long time a year used to seem when we were young children and how, as we grew older, the years seemed to pass faster. Even then, a year during our twenties was apparently a much longer space of time than a year in our forties, and as we approach sixty, a year seems much shorter still.

I have often heard questions raised as to the cause of this apparent acceleration of time with age. At one such discussion many years ago, I suggested that the reason might lie in that elapsed time as measured by the recollection of an individual seemed long or short according to what relationship it had to the individual's total time experience. For instance, at the age of eight, when our memory might go back over four years, a year would represent 25 per cent. of our total remembered time experience and hence seem like a very long time; at the age of twelve, memory may go back over eight years and one year would represent 12½ per cent. of total remembered time experience and could therefore appear to be only half as long as a year did at the age of eight. Similarly, at the age of fifteen, a year would be likely to represent only about 10 per cent. of remembered time and seem still shorter. At the age of 25 it would represent only about 5 per cent. of remembered time and hence seem only half as long as at the age of 15 and possibly one fifth as long as at the age of eight. At the age of 45 to 50, it would represent about 2½ per cent. of remembered time and at the age of 60 only 2 per cent. or less. Thus, as the years roll by, time would seem to be accelerating in speed. Off and on, since then, when such a matter would come up in conversation, I have offered this theory as a possible explanation of this experience, which I believe is quite general. Its reception by scientific friends has encouraged me finally to submit it for wider consideration.

F. W. NITARDY

SCIENTIFIC BOOKS

STRATIGRAPHY

Stratigraphy of the Eastern and Central United States. By CHARLES SCHUCHERT. xvii + 1,013 pp. 4 plates. 123 figs. 78 correlation charts. New York: John Wiley and Sons, Inc. 1943. $15.00.

THIS encyclopedic work by the late Professor Charles Schuchert, of Yale University, is the second volume of three in the series bearing the general title, "Historical Geology of North America." The first volume, "Historical Geology of the Antillean-Caribbean Region, or the Lands Bordering the Gulf of Mexico and the Caribbean Sea," was published in 1935. The third volume, dealing with the stratigraphy of Greater Acadia, eastern, central and Arctic Canada, the Arctic Archipelago and Greenland, was in essentially complete typescript at the time of Professor Schuchert's death and will be published in due time.

Together, the three volumes are designed to document an "Atlas of American Paleogeography," which is to be issued as a part of volume three in the series. They are the product of almost forty years of painstaking examination and correlation of published geological studies supplemented by years of careful field work, particularly within the areas involved in the present volume.

Following a concise and valuable introductory chapter on "Stratigraphic and Time Terms and their Grouping," this volume is divided into eight parts, as follows:

"Part I. The New York Standard." This discussion includes the Paleozoic formations of the State except the "much deformed and much metamorphosed Cambro-Ordovician area of the Taconic Mountains of the Hudson-Champlain valleys." This region is considered to be "in reality . . . but the western margin of Greater Acadia" and will be described in volume III.

"Part II. The States Athwart the Appalachian Geosyncline." Following an introductory statement on the Appalachian geosyncline, the discussion includes the Paleozoic and, generally, the Lower Mesozoic sequences of Pennsylvania, New Jersey, Maryland, Virginia, West Virginia, eastern Tennessee, North and South Carolina, Georgia, Alabama and Mississippi.

"Part III. The Atlantic Coastal Plain." Complet-

ing the examination of the eastern states, this area is divided into three subregions: the northeastern, the middle and the southeastern Atlantic Coastal Plain.

"Part IV. The States Athwart the Cincinnati Anticline." Included here are Central and West Tennessee, Kentucky, Ohio, Indiana and Michigan.

"Part V. The States Around the Ozark Dome." Illinois, Missouri and Iowa.

"Part VI. The States of the Upper Mississippi Valley." Minnesota and Wisconsin.

"Part VII. The Eastern Plains States." North Dakota, South Dakota, Nebraska and Kansas.

"Part VIII. The States to the North and West of the Borderland Llanoria." A general introduction describes and discusses the "Late Paleozoic Oklahoma Mountains of the Llanorian Geosyncline." This is followed by the description of the stratigraphy of Arkansas, Oklahoma and Texas.

Except for Part III the chapters in each part are concerned with the geology of a separate state. In general, each chapter begins with a short history of the early geologic work in the state, followed by a synopsis of the physiography and structure of the area. The major portion is, however, devoted to a highly condensed description of the various formations, and their members are listed together with notes on their general lithology, thickness, important faunal contents and correlation, all being completely documented with bibliographic references. Thus, in contrast to the more narrative style of the first volume of the series, the present has of necessity become almost "telegraphic" in style and is essentially almost an encyclopedia of the stratigraphy of the region covered. It will prove an invaluable tool to the stratigrapher, wherein he can at once find the essential data regarding any formation but from which he will be led, as was clearly intended by the author, to consult the original works for more detailed information.

The three volumes of this series will form Professor Schuchert's most enduring monument. They are a lasting tribute to the insight, organizational ability and untiring energy of a great scientist.

H. E. VOKES

MINERALS AND ROCKS

Minerals and Rocks—Their Nature, Occurrence and Uses. By RUSSELL D. GEORGE. xviii + 595 pp. 68 plates. 150 figs. New York: D. Appleton-Century Company, Inc. 1943. $6.00.

IN this book Dr. George has done an excellent job of bringing together and co-ordinating material from several branches of the geological sciences. It is written especially for use as a textbook in economic mineralogy, and might be considered a reference book on that subject. Because of its broad scope, considerable material useful to a beginner in mineralogy or petrology has necessarily been omitted.

The physical properties of minerals, crystallography and the origin and form of ore deposits are considered in two introductory chapters. Parts I, II and III (Part I, "Metallic Elements and Minerals"; Part II, "Non-Metallic Elements and Minerals"; Part III, "Rock-Making Minerals"), which make up the main portion of the book are devoted principally to the description of mineral species. The minerals are grouped, in general, according to the most important economic element which each contains. Such a classification is, no doubt, desirable in this book, but it has its attendant disadvantages, for it is difficult to pigeonhole many minerals in such a manner. Thus, pyrite and arsenopyrite are considered under iron, although the former is chiefly an ore of sulfur, while the latter is principally an ore of arsenic. Although dolomite is appropriately described under sedimentary rock minerals, it might equally well be considered under ores of magnesium. Before giving the individual descriptions of the minerals brought together under the heading of a common element, a brief account is given of the element itself, its uses, sources and production. These paragraphs contain much valuable information and are particularly instructive.

Part IV, "Determinative Mineralogy," briefly describes blowpipe tests and equipment, lists tests for most of the elements, and includes tables of minerals grouped according to color and luster.

Part V, "The Common Rocks," considers the origin, description and classification of the igneous, sedimentary and metamorphic rocks. The last chapter on "Industrial Uses of Rocks" gives much valuable and interesting material not usually included in books on petrology.

C. S. HURLBUT, JR.

HARVARD UNIVERSITY

QUALITATIVE ANALYSIS

The Theory and Practice of Semimicro Qualitative Analysis. By G. B. HEISIG. xiii + 331 pp. 15 figs. 14 × 21 cm. Philadelphia and London: W. B. Saunders Company. 1943. $2.50.

To the already long list of available texts in qualitative analysis, Professor Heisig has added another which must be justified mainly on the basis of its extensive treatment of the anions, and a thoroughly modern approach to the theoretical matters underlying the practical work. The book is designed for students who have already had a college course in general inorganic chemistry, and follows a strictly semimicro procedure. Very small samples are used (1 mg or 4 drops of unknown solution) and provision is made for filtering by the pressure-bulb method of Barber, as well as for centrifuging.

The theoretical section takes up about one third of the book. This includes modern concepts of complete ionization, acid-base relationships, etc., which are made an integral part of the later discussions in the experimental sections. Especially noteworthy are the up-to-date sections on hydrolysis and amphoterism, the author's treatment of "ammonium hydroxide" as ammonia, and the inclusion of a separate chapter dealing with the concept of activity. To this reviewer, the entire theoretical section, although admirable in its scope, was somewhat lacking in general clarity and readability. There might be mentioned, as contributing to this, rather poor arrangement of the topics discussed and occasional misplaced emphasis. Thus more space is devoted to the nomenclature of Werner compounds than is given to an explanation of their structure.

In the experimental section which follows, 100 pages are devoted to the 24 common cations. General discussion of the chemistry of the several metals and preliminary experiments on the reactions of their ions precede the actual group analysis. The latter follows customary procedure, employing sodium hydrogen sulfide to separate the copper and tin subgroups, and making use of only the most essential organic reagents. A good discussion of the analysis of each cation group follows the description of the procedure. It is unfortunate that a complete summary of the several cation groups is to be found nowhere in the section on cations, but only in the Introduction, and that here the sulfides of Group II are described as "sparingly soluble in water," while those of Group III are said to be "almost insoluble in water."

To the analysis of 24 anions the author devotes 72 pages. The selection is somewhat arbitrary, including for example chlorate, bromate, iodate and perchlorate, but excluding silicate, arsenite, acetate and oxalate. The procedure followed is that of Sneed and Duschak[1] adapted for semimicro use by the author and A. Lerner. It has the advantage of dividing the anions into five mutually exclusive groups, which are separated in order by means of successive precipitations of the calcium, barium, cadmium and silver salts under proper conditions. Without first-hand experience of the method, this reviewer can not form an adequate opinion of its merits.

The Appendix of 21 pages contains several valuable features, including a good review of mathematical operations used in qualitative analysis, and an exhaustive but uncritical list of reference books in qualitative analysis and inorganic chemistry.

This first edition of Professor Heisig's book is marred by numerous small errors and omissions. Misspellings, especially of proper names, are frequent; it is to be hoped that these will be corrected subsequently.

WENDELL H. TAYLOR

DISEASES OF DOMESTIC ANIMALS

The Infectious Diseases of Domestic Animals. By WILLIAM ARTHUR HAGAN, D.V.M., D.Sc., professor of bacteriology and dean of the faculty, New York State Veterinary College, Cornell University. 665 pp. 145 ill. Ithaca, N. Y.: Comstock Publishing Co., 1943. Price, $6.00.

THIS is a well-integrated and entirely adequate account of the host of infectious diseases to which domesticated mammals and birds are subject, of the specific microorganisms involved and of available methods of diagnosis and control. The introductory section of the book is a consideration of the general aspects of infection and disease production by microorganisms, and of the nature and development of the immune response, with a brief review of allergic conditions and of iso-antibodies. Discussion of groups of microorganisms is arranged under the following section headings: Pathogenic Bacteria, Bacteria-like Pathogenic Organisms of Uncertain Classification, *i.e.*, Spirochetes, Rickettsiae and Pleuropneumonia Group, Pathogenic Fungi, Pathogenic Protozoa and Viruses. For each of these groups or, where justified, for individual organisms, consideration follows the general pattern: morphology, reactions in culture, natural habitat, pathogenicity and types of disease in susceptible hosts, diagnostic and control methods, immune response, and, where appropriate, relation to disease of man. These divisions of the subject matter are clearly marked by subtitles in bold face type, giving ready access to any part of the material. To each chapter and to many chapter subdivisions short lists of well-chosen references are appended. This is not a textbook of bacteriology in the usual sense. Instead, its purpose is much broader, and it presents a well-balanced treatment of the important aspects of infectious diseases of lower animals.

HERBERT L. RATCLIFFE

SPECIAL ARTICLES

OBSERVATIONS CONCERNING THE ETIOLOGY OF PRIMARY ATYPICAL PNEUMONIA

THE clinical syndrome currently known as primary atypical pneumonia may be caused occasionally by viruses of the psittacosis group[1,2,3,4,5] or by Rick-

[1] *Jour. Chem. Ed.*, 8: 1177–86 and 1386–95, 1931.

[1] M. D. Eaton, M. D. Beck and H. E. Pearson, *Jour. Exper. Med.*, 73: 64[illegible], 1941.

ettsiae,[6] but in the great majority of cases it is apparent that some other agent is responsible. Within recent months a number of investigators have reported attempts to isolate and identify this agent, which is presumably a virus.[7,8,9,10,11]

Eleven patients severely ill with primary atypical pneumonia were selected for the present study. Sputum, throat washings and blood from nine of these cases were inoculated to animals and birds by several routes, and serial passages were carried out. Specimens of lung and spleen were utilized in a similar manner from the remaining two cases, both of whom died of other causes while the pulmonary infection was present. No gross or microscopic evidence of disease was observed in any of the following species, either after primary inoculation, or after serial blind passage: ferrets, Swiss mice, deer mice, Syrian hamsters, rabbits, white rats (normal, x-rayed, adrenalectomized, splenectomized), cotton rats, rice birds, pigeons.

However, in recently weaned guinea pigs 10 strains of a readily transmissible agent have been isolated from 7 of the 11 patients, as indicated in Table 1.

TABLE 1

Case	Age and sex	Source of strains	Day of disease isolated
J. A.	M 22	Sputum	5
		Blood	4
B. W.	F 22	Throat washings	4
		Sputum	11
D. K.	M 55	Lung	9
		Spleen	9
E. V.	F 24	Sputum	10
B. R.	F 26	Sputum	12
E. L.	F 55	Lung	13
L. F.	M 24	Throat washings	10

Pulmonary lesions appeared in the animals on first passage with two strains, on second passage with two strains, on third passage with five strains and on fourth passage with the remaining strain. The agent produces a disseminated bronchopneumonia which becomes manifest grossly in from 12 to 20 days and shows complete resolution after 45 to 60 days. Successful transmission has been accomplished only by the intranasal route of inoculation. The infective titer is low, usually 10^{-2}, although in one instance a titer of 10^{-4} has been observed.

The various strains have now been carried through from 3 to 16 passages, employing a total of 387 guinea pigs, with no demonstrable alteration in character of the pulmonary disease, and no increase in virulence of the agent. In 90 control guinea pigs the intranasal inoculation of suspensions of normal guinea pig lung, with 3 to 5 subsequent passages, has invariably given negative results.

The agent will pass through a Berkefeld V candle but is retained by filters of smaller porosity. It is unstable and deteriorates rapidly in saline suspensions at both room and ice-box temperatures, but may be protected by broth or normal serum. Potency is maintained for at least 6 months in the frozen state.

Pathologically the pneumonia in the guinea pig is characterized by thickening of the alveolar septa due to congestion and infiltration with mononuclear cells, scanty collections of monocytes in the alveoli and lymphocytic cuffing about the blood vessels and bronchi. Bronchitis is slight or absent. Inclusion bodies, elementary bodies and Rickettsia-like organisms have not been observed. Routine cultures of the lungs on blood agar under CO_2, and at intervals on other media to reveal the presence of anaerobes or organisms of the pleuropneumonia group, at no time have revealed bacteria that could be considered responsible for the disease.

Identity of the various guinea pig strains has been demonstrated by cross-protection tests, recovered animals showing immunity to reinfection with both homologous and heterologous strains. However, pooled convalescent guinea pig sera and sera from immunized rabbits have failed uniformly to neutralize the agent by any of several techniques employed. Neutralization tests with acute and convalescent sera from cases of atypical pneumonia have likewise been unsuccessful. Complement fixation tests with patients' sera proved to be impractical, since we encountered nonspecific fixation with normal tissue antigens.[12]

Attempts to cultivate the agent in the developing hen's egg and in various types of tissue cultures have thus far given negative results.

Although we have been unable to produce pulmonary lesions in the cotton rat by the inoculation of human material, a bronchopneumonia has been regularly produced in this animal following intranasal inoculation of all strains of the guinea pig agent. The incubation period in the cotton rat aver-

[2] K. F. Meyer, *Medicine*, 21: 175, 1942.
[3] J. M. Stickney and F. R. Heilman, *Proc. Staff Meet. Mayo Clin.*, 17: 369, 1942.
[4] J. E. Smadel, *Jour. Clin. Invest.*, 22: 57, 1943.
[5] C. B. Favour, *Am. Jour. Med. Sci.*, 205: 162, 1943.
[6] R. E. Dyer, N. H. Topping and I. A. Bengtson, *Pub. Health Rep.*, 55: 1945, 1940.
[7] J. A. Baker, SCIENCE, 96: 475, 1942.
[8] M. D. Eaton, G. Meiklejohn, W. Van Herick and J. C. Talbot, SCIENCE, 96: 518, 1942.
[9] F. G. Blake, M. E. Howard and H. Tatlock, *Yale Jour. Biol. and Med.*, 15: 139, 1942.
[10] J. H. Dingle *et al.*, *War Med.*, 3: 223, 1943.
[11] F. L. Horsfall, Jr., E. C. Curnen, G. S. Mirick, L. Thomas and J. E. Ziegler, Jr., SCIENCE, 97: 289, 1943.
[12] L. Thomas, E. C. Curnen, G. S. Mirick, J. E. Ziegler, Jr., and F. L. Horsfall, Jr., *Proc. Soc. Exper. Biol. and Med.*, 52: 121, 1943.

ages one week. Pulmonary involvement is often extensive, but the animals rarely die. On section the lungs of infected cotton rats show an alveolar exudate rich in polymorphonuclear neutrophiles. Bronchitis is frequently observed. The picture suggests a bronchopneumonia caused by bacteria, but cultures have regularly failed to reveal significant microorganisms. Moreover, the agent is transmissible after filtration through a Berkefeld V candle, as in the guinea pig.

Selected cotton rat strains have been carried through 12 to 19 passages, employing a total of 334 animals. In 47 control cotton rats no pulmonary lesions have been observed, following the intranasal inoculation and subsequent passage of normal lung suspensions.

The cotton rat strains have been shown to be antigenically similar to one another by cross-protection tests. Furthermore, recovered cotton rats are immune to reinoculation with homologous and heterologous strains of the guinea pig agent, thus demonstrating that the agents in the cotton rat are identical with the original guinea pig strains.

Neutralization and complement fixation tests with the cotton rat strains, employing sera from patients, convalescent rats, convalescent guinea pigs and immunized rabbits, have given inconclusive results.

However, both guinea pigs and cotton rats repeatedly injected by the intranasal route with human material, including sputum, throat washings, lung and spleen, develop a partial or complete immunity to infection with passage strains of the agent from either the guinea pig or the cotton rat.

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LOSS OF PROPRIOCEPTIVE REFLEXES FOLLOWING RETROGRADE DEGENERATION[1]

ACHESON, Lee and Morrison[2] have reported a decrease in spontaneous respiratory activity in the cut phrenic nerve during the period of retrograde degeneration. To check the nature of this deficiency and to define it in terms of spinal reflexes a study was made of a series of cats in which the sciatic nerve had been cut. Stimuli were delivered as single shocks to the peripheral nerves or to the dorsal roots, and recordings were made from the dorsal and ventral roots with a cathode ray oscillograph.

[1] From the Department of Neurology, College of Physicians and Surgeons, Columbia University. Aided by a grant from the National Foundation for Infantile Paralysis.

[2] G. H. Acheson, E. S. Lee and R. S. Morrison, *Jour. Neurophysiol.*, 5: 269, 1942.

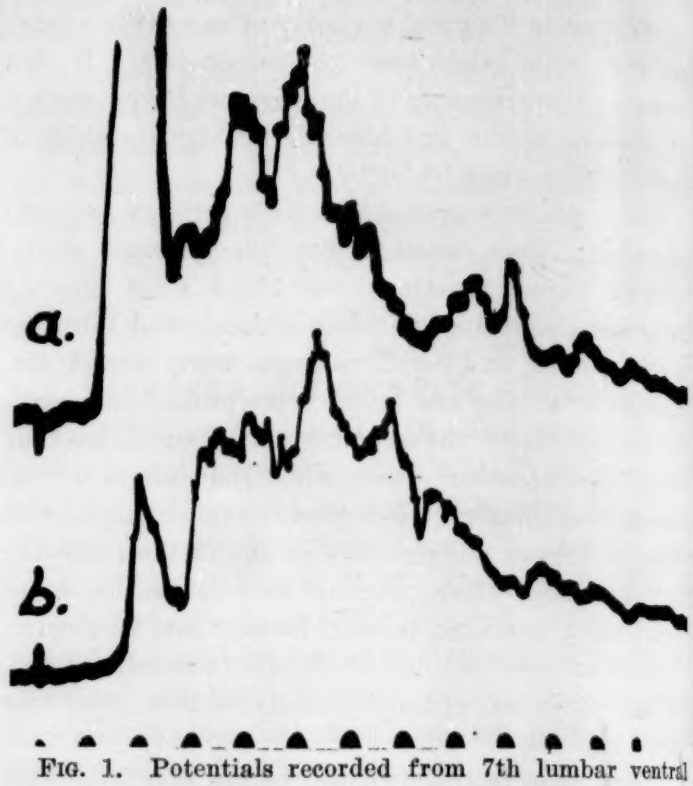

FIG. 1. Potentials recorded from 7th lumbar ventral root in a cat which had had the right sciatic nerve cut 12 days previously. The stimulus was in each case a single condensor discharge to the dorsal root. (*a*) Left side. (*b*) Right side. Time intervals, 1 millisecond.

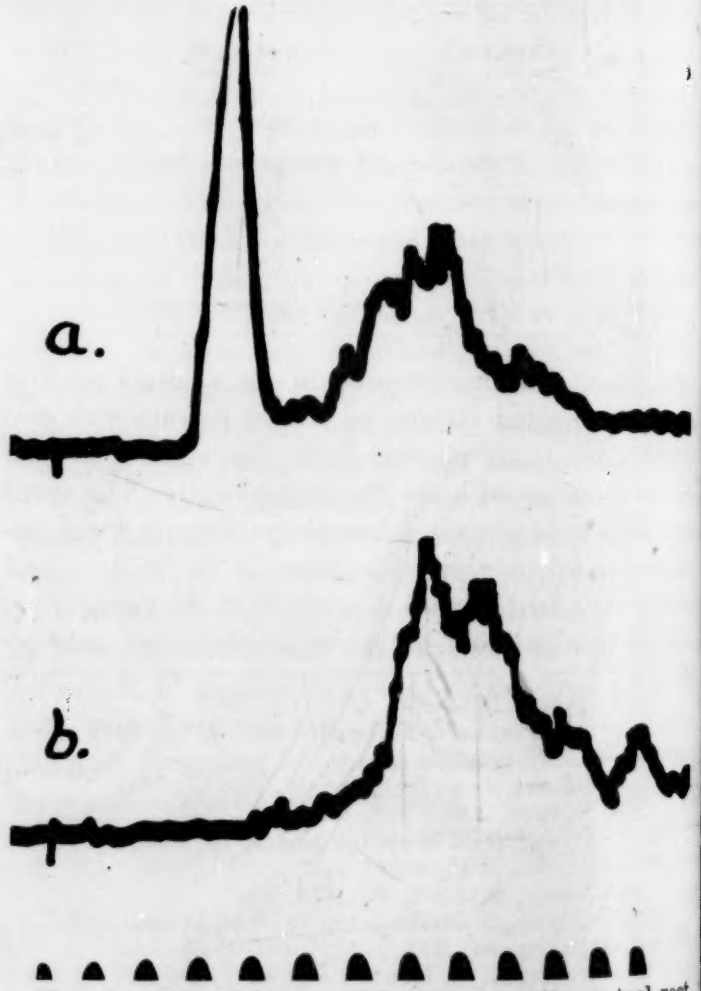

FIG. 2. Potentials recorded from seventh ventral root of same preparation in response to stimulation of the central ends of the cut sciatic nerves. The conduction distances on the two sides were approximately equal. (*a*) Left side. (*b*) Right side. Time intervals, 1 millisecond.

Records of the dorsal-ventral root reflexes allow differentiation of the proprioceptive or myotatic reflexes (the 2 neuron reflex of Renshaw,[3] and Lloyd,[4]) and the flexor or cutaneous reflex. Fig. 1*a* illustrates the normal record from the 7th lumbar ventral root, following stimulation of the corresponding dorsal root, of these reflexes on the control side of a cat in which the peroneal, tibial and hamstring nerves had been unilaterally sectioned 12 days previously. The high initial spike represents the proprioceptive reflex, the slower later activity the flexor response. Fig. 1*b* illustrates the alteration found on the degenerated side. Note the small proprioceptive component which must be ascribed to the activity of the undegenerated nuclei of the gluteal and other hip muscles. Fig. 2*a* shows the response in the 7th lumbar ventral root of the same preparation following stimulation of the normal sciatic nerve at the level of the greater trochanter. The separation of the proprioceptive and the flexor reflexes is well marked. On the degenerated side, when the sciatic nerve was stimulated at a comparable level, the proprioceptive reflex was absent, though the flexor response was essentially unaltered. Histological check revealed extensive chromatolysis of ventral horn cells had followed the nerve section.

This effect has been found in all cats allowed to degenerate after section of the sciatic nerve over a period of from 10 to 27 days. Records were made on the 10th, 11th, 12th, 14th, 18th, 20th and 27th postoperative days. Further studies are in progress to determine the early time course of the phenomenon and to resolve the mechanism by which the deficiency is related to chromatolysis.

Summary. Section of peripheral nerves in cats leads to the loss of the ventral root potentials homologous with the proprioceptive reflex during the period of retrograde degeneration. The corresponding potentials of the flexor reflex are essentially unchanged.

BERRY CAMPBELL

SCIENTIFIC APPARATUS AND LABORATORY METHODS

AN IMPROVED INSTRUMENT FOR MEASURING CAPILLARY FRAGILITY

IN a study of the effects of substances on the resistance of the capillary wall, Dalldorf's modification[1] of the Da Silva-Mello technique was used. Considerable difficulty, however, was experienced in visualizing the field and recognizing the appearance of petechia. The modification to be described here largely overcomes this difficulty.

The fragility of the vessels of the skin is determined by estimating their resistance to negative pressure. The apparatus as used by Dalldorf consists of a mercury manometer connected to a small cylinder approximately one centimeter in diameter and one and a half centimeters in length. One end is sealed with a glass window, while the open end is placed over the skin area. In order to obtain airtight contact with the skin and at the same time not exert undue pressure, a flat rim is attached to the open end. By means of rubber tubing the manometer and cylinder is attached to a vacuum pump. With the cylinder placed on the skin, the minimum decompression at which petechia are formed in one minute is taken as the end point.

Our modification (Fig. 1) consists in changing the small end of one speculum of an electric pneumatic otoscope into the shape of the lower end of the above described cylinder and using the otoscope with its lens system in place of the cylinder and the plain glass window. In order to convert the standard otoscope for use in this work, it is only necessary to modify one of the specula. This is cut off at a

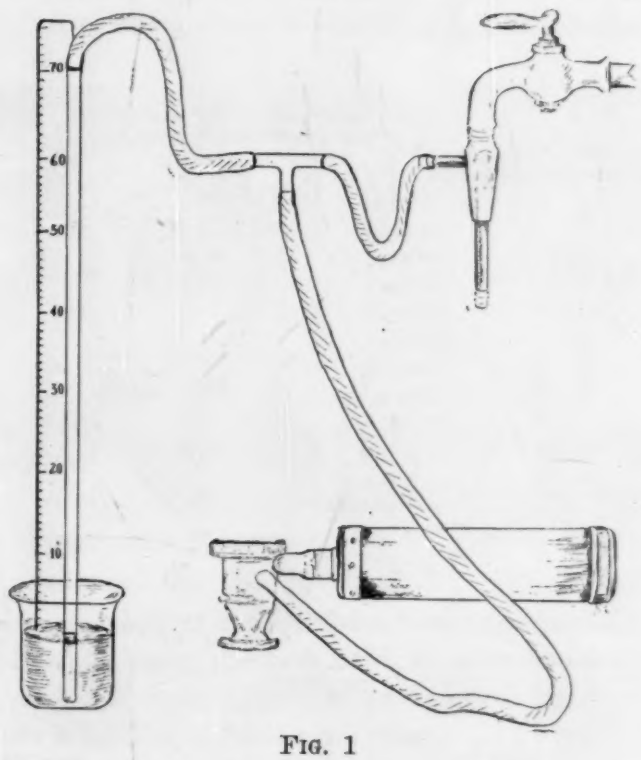

FIG. 1

point at which its diameter is approximately one cm and the small end replaced with a washer one and one half cm in diameter. When made smooth, this washer forms the surface to be applied to the skin. The tube branching from the side of the head of the otoscope is connected to the manometer and the vacuum pump by means of a piece of rubber tubing. The convex lens and small bright light make the petechia easily recognized. If a small portable

[3] B. Renshaw, *Jour. Neurophysiol.*, 3: 373, 1940.
[4] D. C. P. Lloyd, *Jour. Neurophysiol.*, 6: 111, 1943.
[1] *Jour. Exp. Med.*, 53: 289, 1931.

vacuum pump powered with an electric motor is available to produce the decompression the apparatus can be used on the hospital wards for clinical investigation. If used in the laboratory for animal experimentation a filter pump, as shown in the figure, connected to the water line will be found quite satisfactory. A small vacuum tank may be included in the system to take care of any changes in pressure due to pressure changes in the water line.

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A SIMPLIFIED ALL-PURPOSE GRAVITY WRITING LEVER

SINCE describing an inexpensive gravity writing lever for respiratory tambours[1] we have simplified and extended the usefulness of the apparatus. The principle of a carrier holding a writing arm in such a manner that gravity will cause this arm to contact the drum is the same as previously described. The difference is that the carrier has been made smaller and lighter in weight and thus applicable to heart and muscle levers. The simplified carrier is made from the ordinary aluminum writing arm wire. It is illustrated in the figure and is easily made as follows:

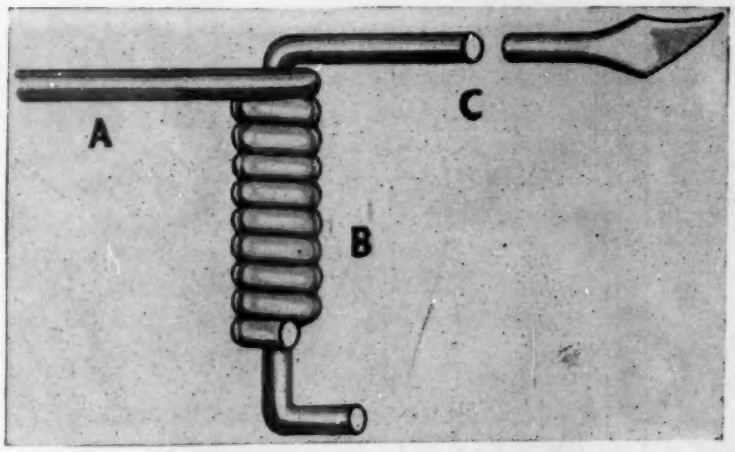

FIG. 1.

A close spiral about one-half inch in length is wound at one end of a four- or five-inch piece of the wire. The spiral is then bent at a right angle to the rest of the wire (A). About three-fourths inch of a second wire (C) is bent to nearly a right angle. The short arm of this right angle is inserted longitudinally through the spiral and its protruding end bent to hold it in place. Joined in this fashion the spiral and the short arm of the second wire make a hinge (B) which permits the long arm of the wire (C) to act with gravity and fall against the drum. The straight arm of the first wire (A) is inserted in the spindle in the usual manner. The sensitivity of the lever may be varied by the amount of tilt given the hinge (B) and by changes in the weight and length of the second wire (C). This lever is as satisfactory as many complicated models now on the market and can be made by students in a few minutes from their old levers.

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[1] SCIENCE, 96: 590, 1942.

A SIMPLE TIMING DEVICE FOR SPEAKERS

EVERY one attending conventions, such as those of our scientific associations, has been impressed by the necessity of controlling the time used by the speakers on crowded programs. One speaker running much over the 12, 15 or 30 minutes of time allotted to him may considerably disrupt a morning or afternoon program. The chairman naturally hesitates out of courtesy to the speaker brusquely to interrupt him and may merely announce "Time" or sharply tap with a pencil when his time is up. This introduces a personal element which may be irritating to some.

While presiding over the recent meetings of the North Dakota Academy of Science I used a photographic interval timer clock which several speakers afterwards commended. The speakers were allotted 15 minutes and I announced several times that the clock would be set to "tinkle" at 13 minutes, allowing two minutes to finish. When the speaker commenced to talk the clock was set and was thereafter ignored. No further personal element was interjected and the alarm went off impersonally for all. The "tinkle" was subdued by placing the clock under a hat.

NEAL A. WEBER

UNIVERSITY OF NORTH DAKOTA

BOOKS RECEIVED

FALES, HAROLD A. and FREDERIC KENNY. *Inorganic Qualitative Analysis.* Illustrated. Pp. ix + 237. D. Appleton-Century. $2.65.

HAYS, F. A. and G. T. KLEIN. *Poultry Breeding Applied.* Illustrated. Pp. 192. Poultry-Dairy Publishing Co.

HEALD, FREDERICK D. *Introduction to Plant Pathology.* Illustrated. Pp. xii + 603. McGraw-Hill Book Co. $4.00.

JEAN, FRANK CONVERT and OTHERS. *Man and His Physical Universe.* Illustrated. Pp. viii + 607. Ginn and Company. $3.25.

LINDSAY, ROBERT BRUCE. *Handbook of Elementary Physics.* Illustrated. Pp. xv + 382. The Dryden Press. $2.25.

RUPPERT, KARL and JOHN H. DENISON, JR. *Archaeological Reconnaissance in Campeche, Quintana Roo, and Peten.* Illustrated. Pp. vii + 156. Carnegie Institution of Washington. $4.25, paper cover; $4.75, cloth binding.

SCHMIDT, CARL L. A. *Addendum to the Chemistry of the Amino Acids and Proteins.* Illustrated. Pp. xii + 1290. Charles C Thomas. $5.00.

SHERMAN, HENRY C. *The Science of Nutrition.* Pp. x + 253. Columbia University Press. $2.75.

STILES, KARL A. *Laboratory Explorations in General Zoology.* Illustrated. Pp. x + 265. Macmillan. $2.50.

WINSLOW, CHARLES-EDWARD A. *The Conquest of Epidemic Disease.* Pp. xii + 411. Princeton University. $4.50.